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American Foundryman

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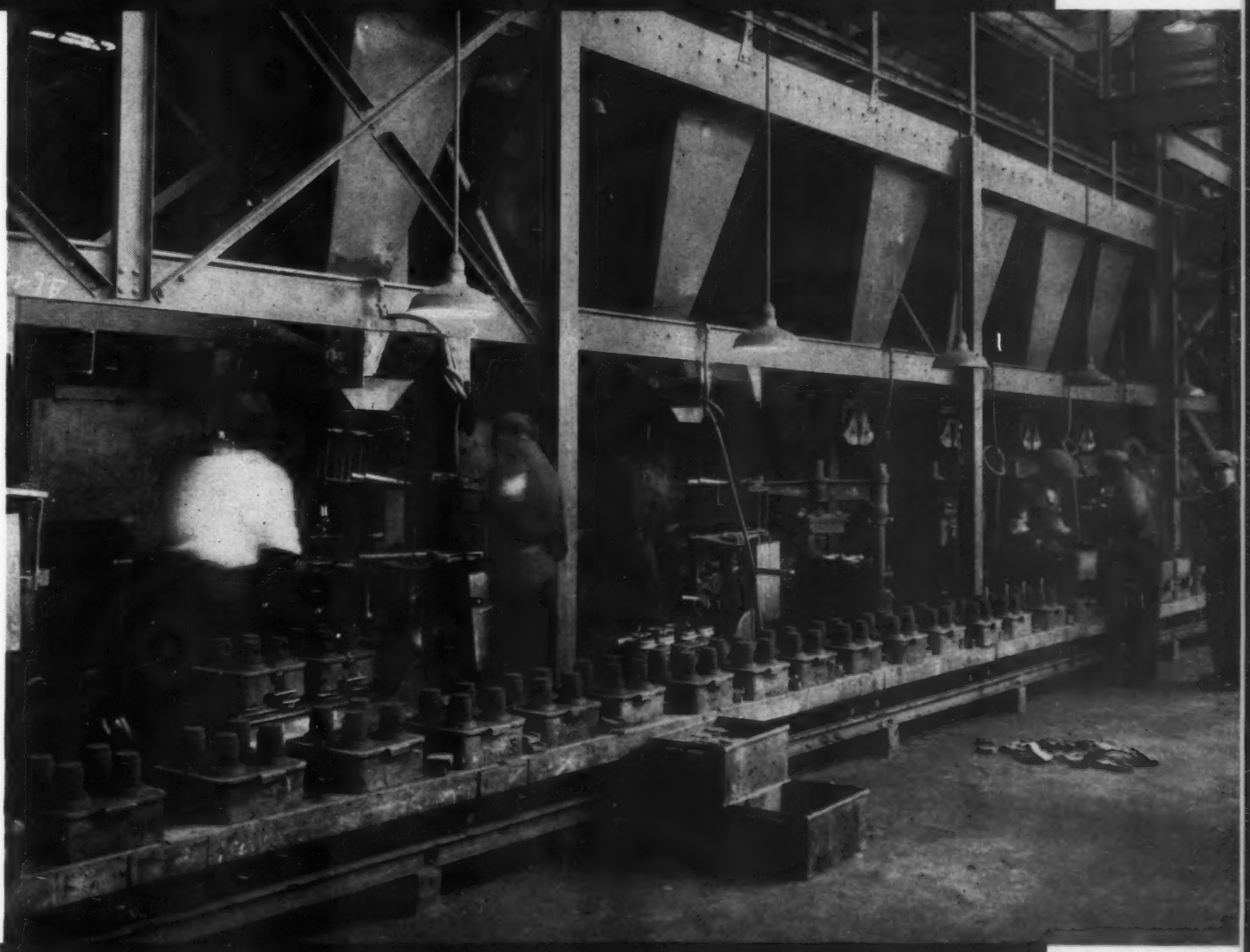


October
1940

Foreman Training Responsibilities

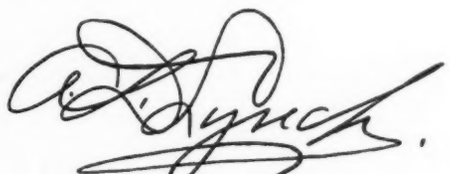
The FOUNDRY, in common with all industry, is and has been battling for its very existence, for its proper place in American industrial life. For many years, this was, for the most part, a battle on the technical front. Forgings, drawn and extruded shapes were replacing castings for many uses, providing physical properties, meeting physical requirements, that foundry products of only a few years ago could not provide. The foundry as an industry met this challenge. New alloys in both ferrous and non-ferrous castings have been produced that meet modern requirements. The A.F.A., through its national organization and its many local chapters, gave substantial aid in this battle.

Today all industry is fighting another battle for its life, for the preservation of free enterprise, for the continuation of our present economic system. Government, through legal restrictions, excessive taxation, and support of radical labor leadership, has provided the background and equipment that is being used to destroy this system financially, and to break down good-will, cooperation and recognition of mutual interest between those who manage and those who work. The control of human values, of human relations, of people, rather than products, is at stake in this contest and we dare not lose.

The battle for the improvement of foundry products was won in our laboratories and work shops by the improvement of foundry equipment, by the control and alloying of metals, furnaces, temperatures, sands, patterns, gating and many other technical foundry practices. The battle for the control of the management of people will be won or lost in our foundries, on the firing line where management and worker meet, and our foundry foremen carry management's part of the responsibility for the successful conduct of this struggle.

Methods and procedure in industrial relations have changed. Foremanship responsibilities have been multiplied. The Foundry Industry, ruled by traditions and inhibitions of the past, has been slow to meet some of these changes. Competent management policies must be established, and leadership must be provided that will make such policies effective.

This means training of those men who are on the firing line, who make our human contacts, our foremen. The American Foundrymen's Assocaition, through its executive offices and through its local chapters, will aid and assist in this as in all efforts to improve and maintain the prestige and success of the Foundry Industry. Call on your local chapter for support and guidance, or on your Committee on Foremen Training.



A. D. LYNCH, Chairman
A.F.A. Committee on Foremen Training

A. D. Lynch, who for several years has been chairman of the A.F.A. Committee on Foremen Training, is Personnel Director, Young Radiator Co., Racine, Wis. Previous to accepting his present position, he held similar positions with the J. I. Case Co., Racine, Wis., Hammond Brass Works, Hammond, Ind., and the Ohio Brass Co., Mansfield, Ohio. The Committee on Foremen Training for several years has issued special reports containing papers describing problems connected with foremen training. Associated with Mr. Lynch on this committee are E. A. Bacon, president, Smith Steel Foundry Co., Milwaukee; W. G. Conner, Jr., supt. of foundries, Walworth Co., Greensburg, Pa.; W. E. George, assistant to management, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; G. J. Leroux, assistant manager, National Malleable & Steel Castings Co., Cleveland, and A. C. Ziebell, president, Universal Foundry Co., Oshkosh, Wis.

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American Foundryman

CONTENTS

October, 1940

Volume 2 **Number 10**

	Page
Foreman Training Responsibilities, *by A. D. Lynch*	Inside Front Cover
Metallic Electrodes for Gray Cast-Iron Welding, *by F. W. Scott*	2
Tribute to the Memory of John A. Penton	9
Development of Some Gating and Feeding Methods for High Duty Alloys—1, *by A. E. Cartwright and C. C. Brisbois*	10
Foundrymen to Take Part in Safety Congress	14
Foundrymen to Meet at Baltimore	14
Chapter Activities	15
Chapter Chairmen	20
New Members	21
Abstracts of Current Foundry Literature	22
Chapter Schedule for October	25

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Metallic Electrodes for Gray Cast-Iron Welding†

By Frank W. Scott*, Minneapolis, Minn.

Introduction

THE welding of gray cast iron has been one of the most difficult operations that the industry has had to carry out. This has been due to the fact that the characteristics of gray cast iron have not been thoroughly appreciated. Particularly, the effects of change in chemical analysis, rates of cooling, and shrinkage of deposited metal have not been evaluated.

Recently, experiments have been concluded proving that gray iron can be successfully welded using cast-iron rods with alloy coatings. Using preheated castings, arc deposited weld metal has been found to be readily machinable, free of blowholes, oxides and hard spots, even at the line of fusion. It has been demonstrated that the usual tendency for cracking due to excessive strains may be avoided. This deposit is also advantageous where appearance is important since the metal is homogeneous.

Relationship of Structure of Gray Cast Iron to Its Physical Properties

To develop the welding rod that gives the results just described, it has been necessary to make a fundamental study of the factors controlling the complex structure that we know as common gray iron. Small changes in this structure make very pronounced differences in the physical properties of the iron.

Gray irons are principally alloys of iron, carbon and silicon, and are characterized by a gray fracture of the metal. This gray color is the result of the cast iron being non-uniform in structure. The matrix, or body, of the cast iron is made up of two constituents known as ferrite and pearlite. The ferrite is a very soft constituent (pure iron) and the pearlite is made up of alternate plates of ferrite and cementite, the latter being a chemical compound, Fe_3C. Cementite, or iron carbide, is very brittle, and the hardest constituent found in iron or steel. Pearlite has a tensile strength of approximately 115,000 pounds per square inch, an elongation of 15% in 2 inches, and its Brinell hardness is about 200. Its properties are controlled by the thickness of the laminae which seldom measure over 0.0004 inch in thickness. The ferrite plates have approximately a tensile strength of 40,000 pounds per square inch, an elongation of over 50% in 2 inches, and a Brinell hardness of about 80 while the cementite plates have no ductility and a Brinell hardness of over 600. The properties of pearlite are due to the mixture of these components. The metallic matrix of gray iron is filled with numberless flakes of graphitic carbon which are soft and similar to natural graphite. These flakes give the gray iron its typical dark gray fracture.

The strength of gray cast iron is controlled, to a great extent, by the relative amounts of ferrite and pearlite present. A combined carbon of about 0.60-0.70% will give a matrix that is nearly all pearlitic. Lower combined carbons produce more ferrite, and a softer matrix. As one part of combined carbon, by weight, gives about 117 parts of pearlite by volume, small changes in combined carbon will greatly affect the physical properties of the gray iron. The highest test irons are almost all

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†Reprinted from June, 1940, *The Welding Journal*.

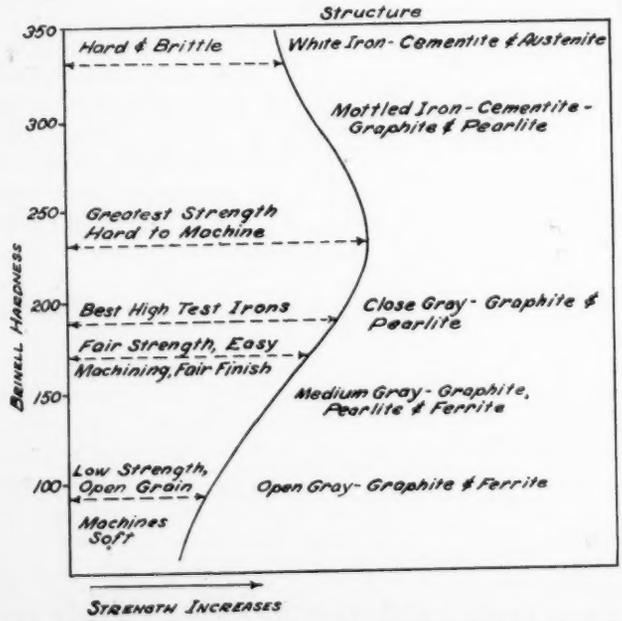


Fig. 1—Qualitative Diagram for Cast Iron Showing Tensile Strength and Hardness Relation. (A.S.M. Metals Handbook.)

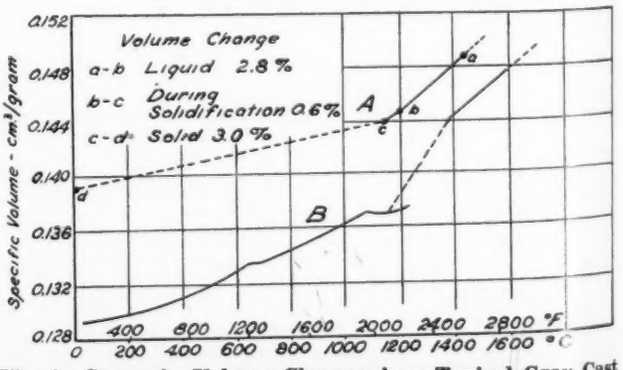


Fig. 2—Curve A—Volume Changes in a Typical Gray Cast Iron. Curve B—Specific Volume-Temperature Relation of a White Cast Iron. (A.S.M. Metals Handbook, 1939.)

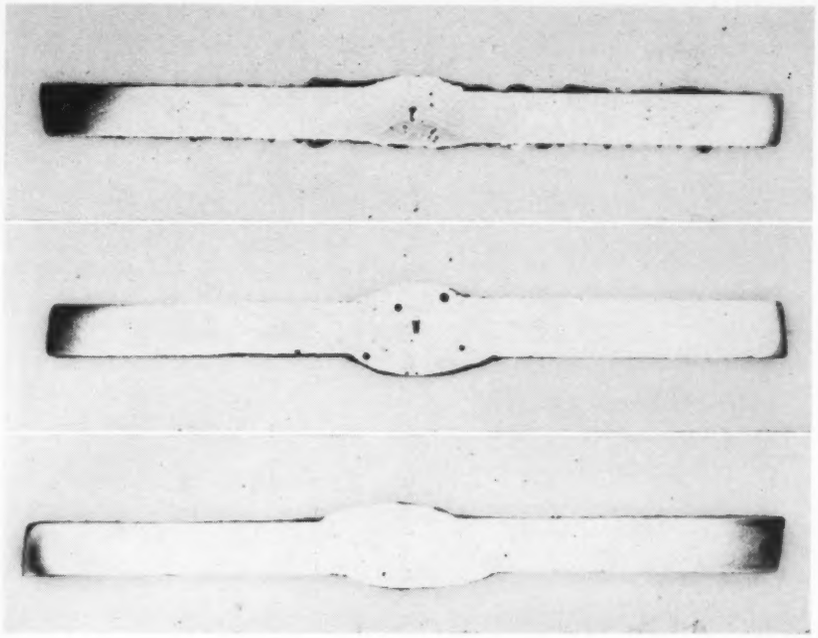


Fig. 3—Comparison of Macrostructures of Welded Cast Iron Sections. Polished, Unetched. Top—Butt-Weld Using Steel Rod. Full Size. Center—Butt-We'd Using Bare Cast Iron Rod. Full Size. Bottom—Butt-Weld Using Alloy-Coated Cast Iron Rod. Full Size.

pearlitic. In these ways, the body of cast iron is seen to be similar to steel, but the effect of the thousands of crystalline flakes of graphite must not be overlooked.

The soft and weak flakes of graphite break up the continuity of the "steel" matrix and lessen the strength of the iron. Often their effect is so great that they control the strength of the iron. They are responsible for the lack of appreciable ductility, but are also responsible for its easier machinability. The effects of the graphite flakes are proportionate to their size, distribution and number. As graphite is much lighter in weight than the "steel" matrix, it occupies a greater volume; three per cent of graphitic carbon by weight occupies about twelve per cent by volume. The greater the amount of graphite the lower the strength, the lower the Brinell hardness, and the greater its machinability. Figure 1 shows a qualitative diagram of the relationship between gray iron structure, tensile strength, Brinell hardness numbers and machinability.

Effect of Cooling Rate on Structure

Deposited weld metal cools very rapidly from the molten condition. This is unavoidable due to the conditions under which it is melted. When molten, cast iron has all its carbon in solution. The bulk of the casting being welded absorbs the heat from the molten weld metal, and quickly reduces its temperature below the point at which graphitic carbon may be precipitated. Thus, metal of such composition which on cooling in the ordinary way would be a gray-iron casting, is white, chilled iron, or is completely or partially enveloped in a hard, white skin of cementite. Preheating the casting, before welding it, slows down the rate of heat loss from the weld metal and reduces the amount of carbon retained in the combined form.

A slow cooling of cast iron permits grain growth, greater degrees of lamination of pearlite, and large flake size of graphitic carbon. A more rapid cooling of the iron may result in the retention of various transition products, as sorbite, troostite or martensite. Any of these transition forms will result in the iron having greater strength and hardness. Machinable welds are dependent upon the formation of graphite and pearlite, and the absence of free cementite. The cooling rate is of extreme importance but may be beyond the control of the welder. The structure of the weld is then controlled by its chemical composition.

Effect of Chemical Composition on Structure

It is difficult to produce graphite in strictly pure iron-carbon alloys. The formation of graphite is favored by the presence of silicon. It promotes the decomposition of the combined carbon in free cementite and in pearlite to form ferrite and graphite. In the absence of silicon, the high carbon irons have a white or cementitic fracture. Just sufficient silicon should be used to insure the decomposition of the free or massive cementite and not enough to cause the decomposition of the cementite in the pearlite. The excessive decomposition of the pearlite gives graphite and ferrite, and a weak, soft iron.

The production of a machinable cast-iron weld requires the composition of the metal to be such that graphite will be formed from the decomposition of free cementite and pearlite even though the solidifying period be only a few seconds. The rate of graphitization is increased by increasing the silicon and carbon content of the metal. Therefore, it is possible to obtain high strength, machinable cast-iron welds by adding these elements to weld metal produced by the melting of ordinary cast-iron rod in the electric arc.

The fluidity or "running qualities" of the weld metal are important as the weld metal bead should be flat and flow out smoothly where it meets the casting being welded. Also, a fluid metal permits the free escape of any entrapped gas. The fluidity of the metal depends upon its temperature and the composition of the metal. The degree of this fluidity depends on the current used in depositing the weld metal, and that can be controlled according to the size of rod being used. More important, the carbon and silicon needed to produce the machinable weld metal also promote the running qualities of the metal. This is due to the lowered initial solidification point. A white iron containing

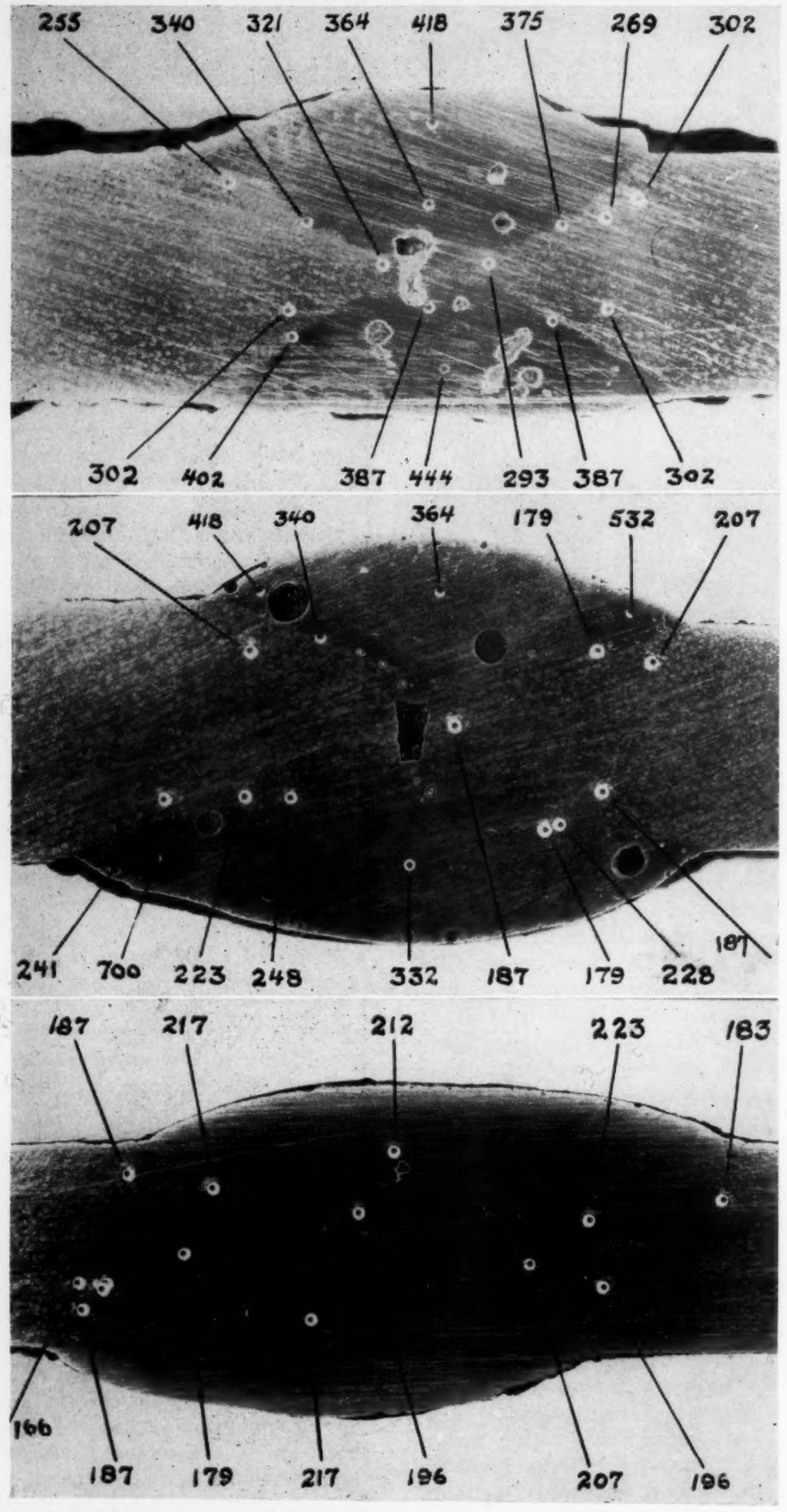


Fig. 4—Comparison of Macrostructures of Welded Cast Iron Sections, Polished, Unetched, Showing Brinell Hardness Numbers. Top—Butt-Weld Using Steel Rod, X5. Center—Butt-Weld Using Bare Cast Iron Rod, X5. Bottom—Butt-Weld Using Alloy-Coated Cast Iron Rod, X5.

2.00% carbon and 0.85% silicon may solidify as high as 2500°F., and an iron of eutectic composition as low as 2066°F.

The cracking of welds or the metal welded is a common fault when cast irons are fused together. This is due to the phenomena of contraction. Three contraction phenomena occur during the cooling of the weld metal from the molten state to room temperature: (1) in the liquid, (2) during solidification, (3) after solidification. These are shown diagrammatically as curves A and B, Fig. 2, taken from charts by Ash and Saeger.[1] They found total linear contractions (2102°F. to room temperature) of 0.67% for a highly ferritic iron to 1.10% for irons with pearlitic matrix. Typical white irons had 2.0% total linear contraction over the same temperature range.

Volume shrinkages are shown in Fig. 2. It may be 4.0-5.0% for white irons, 1.94% for an iron containing 0.90% combined carbon, or even a negative shrinkage for ferritic irons. When cast iron is welded with an uncoated cast rod, the oxygen of the air reduces the carbon and the silicon content to a low level. Because of this, and the rapid rate of cooling, the weld contains a high percentage of combined carbon. Cementite has large volume contraction, and causes strains to be set up which crack the metal. A similar situation arises where a low carbon steel rod is used. This low carbon steel mixes with high carbon iron, diluting the carbon and the silicon, and the resulting iron is hard and white, having large contraction properties. The only way to avoid this contraction so the shrinkage will be negligible is to add carbon and silicon in the rod coating in such amounts that the weld metal will be gray, containing free graphite and low combined carbon.

Macrostructure and Brinell Hardness of Cast-Iron Welds Using Various Types of Welding Rods

Most foundries use steel rods in repairing faulty castings because these are inexpensive, and produce a weld that may be ground smooth, and have satisfactory appearance and strength. It is recognized that these welds are too hard to be machined and that they are slightly porous.

Other welders have used bare cast-iron rods, or some that have

[1]Ash and Saeger, *Trans.*, A.F.A. 1932, p. 189.

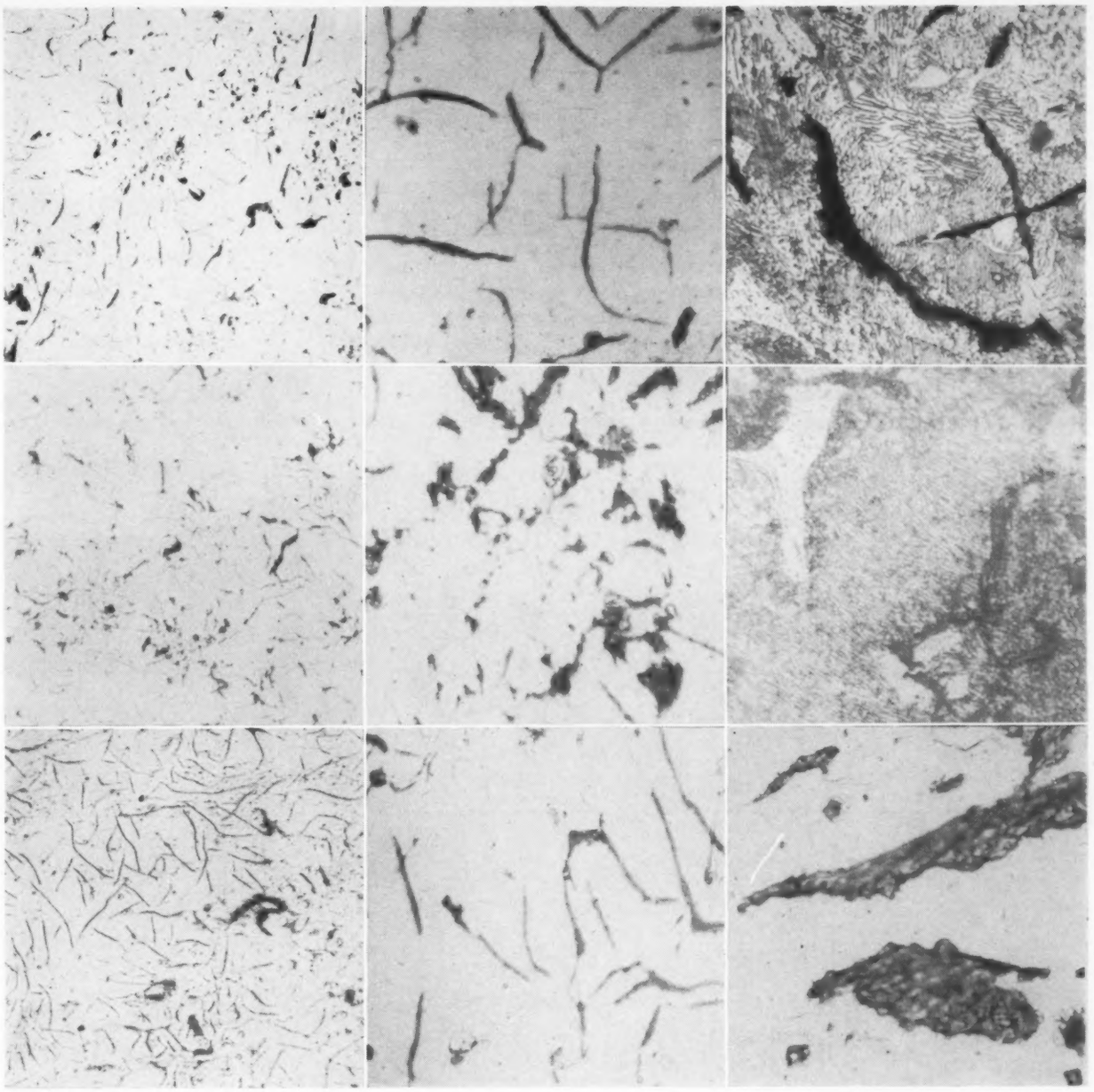


Fig. 5—Comparison of Microstructures of Base Metal Before Welding.
Top Row—Metal Welded with Steel Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.
Center Row—Metal Welded with Bare Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.
Bottom Row—Metal Welded with Alloy-Coated Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.

a light wash of lime and silicate. The weld metal produced from such a rod is chemically similar to the cast iron, but contains free cementite at the line of fusion, and considerable porosity. Because of this relatively small improvement over, and its higher cost than the steel rod, the use of this rod has been limited.

The following photographs show the comparison of the types of welds produced by the two rods mentioned, and the new, improved type of alloy coated rod. These specimen welds were made by butt welding two, quarter-inch, gray cast-iron plates together after they had been preheated to about 600°F. The surface of the iron was not specially prepared, having a light oxide scale common to cast iron coming from the tumbler.

In Fig. 3, the macrostructures of the test pieces are compared. The photographs, taken full size, illustrate the typical weld structures produced by the rods. The steel rod, with its organic-mineral extruded coating, produces weld metal that is smooth and continuous on the surface, but porous. This porosity is due to the reaction of the carbon in the cast iron with the iron-oxide present in the low carbon steel rod. The penetration of the metal from the two sides was not sufficient to join the edges of the test plates, leaving the openings seen. Using the bare cast-iron rod, the surface of the weld metal again appears continuous, but the section shows it to be porous. Again, the penetration is insufficient to weld the two edges completely. The section of the weld produced using the alloy coated rod shows it to

Table I

CHEMICAL ANALYSIS OF THE CAST-IRON WELDING RODS

Carbon %	Manganese %	Phosphorus %	Silicon %	Sulphur %
3.37	0.49	0.885	3.11	0.060

be free of porosity, with deep penetration. The contour of the weld indicates that the metal was very fluid.

These same welds, magnified five times, are shown in Fig. 4. In addition to a better study of the appearance of the welds, the hardness of the metal and of the zones immediately adjacent to them is given. Comparing these Brinell hardness numbers to Fig. 1, only the weld produced with the alloy coated rod is machinable. The weld produced with the steel rod is uniformly hard. This is the result of the admixture of steel and iron. The bare cast-iron rod produces a weld that has hard spots in it, especially next to the line of fusion where the chill was most rapid. This rod, with the analysis shown in Table 1, would, with normal cooling rates, produce graphitic metal.

Using the rod bare, the oxygen of the air reduces the silicon content, and the rapid cooling makes the weld hard. Using the same rod, coated with carbon and ferro-silicon, the weld metal is uniformly soft and machinable.

Mircostructures of Cast Iron Before and After Welding, With Fusion Line and Weld Metal Studies

The quarter inch cast iron plates used as test specimens had different microstructures, as

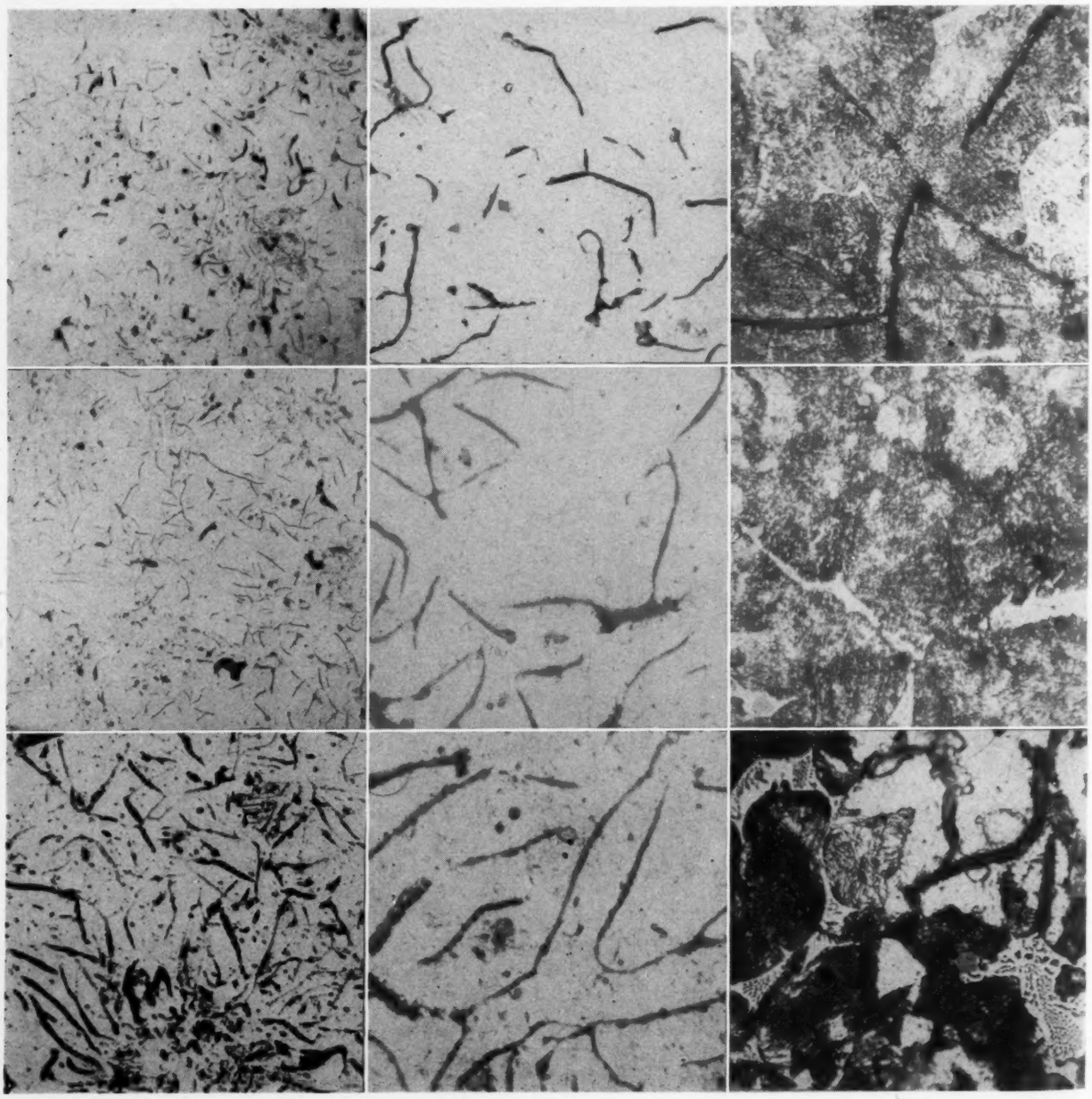


Fig. 6—Comparison of Microstructures of Metal Immediately Adjacent to Weld, Showing Effect of Heating During Welding. Top Row—Metal in Zone Adjacent to Weld Made with Steel Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.

Center Row—Metal in Zone Adjacent to Weld Made with Bare Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.

Bottom Row—Metal Adjacent to Weld Made with Alloy-Coated Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.

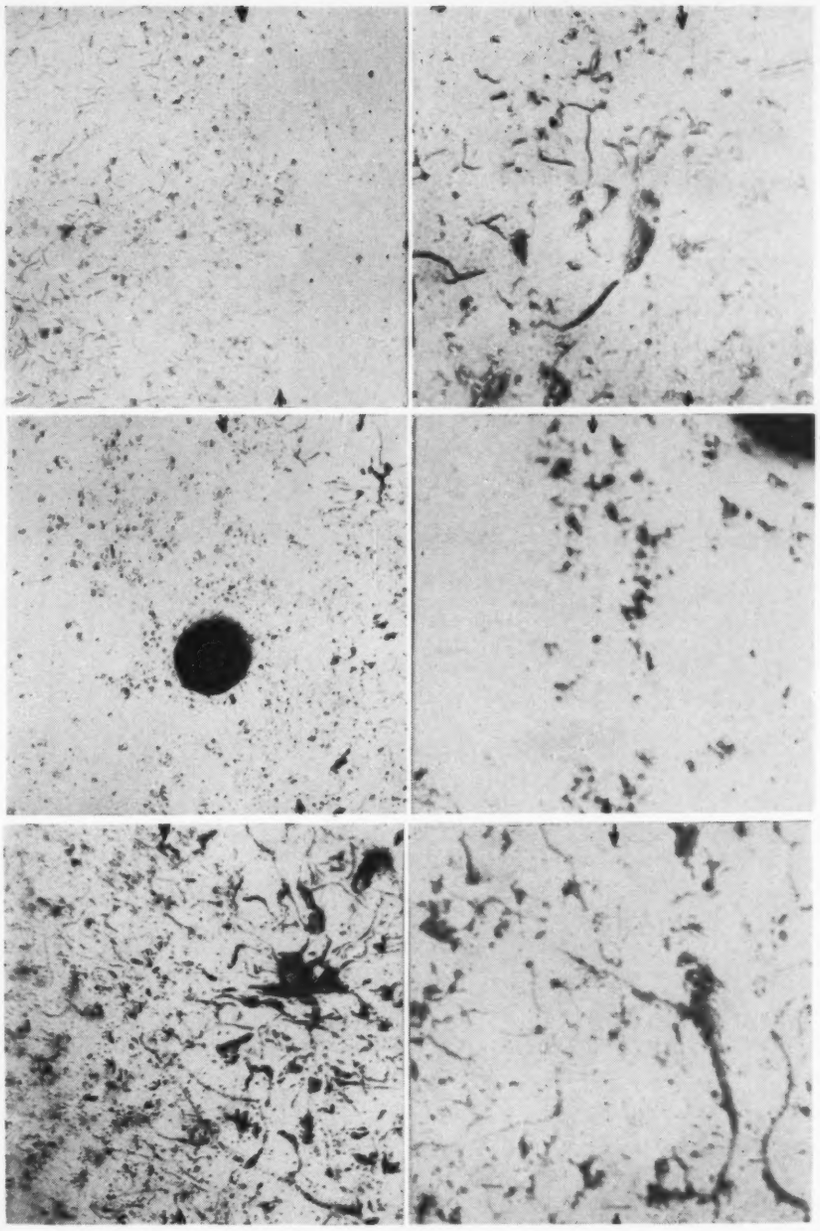


Fig. 7—Comparison of Microstructure of Metal at Line of Fusion. Arrows Point to Line of Fusion.
Top Row—Line of Fusion Between Weld Made with Steel Rod and Cast Iron. Brinell Hardness, 387. Left—Unetched, X100. Right—Unetched, X500.
Center Row—Line of Fusion Between Weld Made with Bare Cast Iron Rod and Cast Iron. Brinell Hardness 418. Left—Unetched, X100. Right—Unetched, X500.
Bottom Row—Line of Fusion Between Weld Made with Alloy-Coated Cast Iron Rod and Cast Iron. Brinell Hardness, 217. Left—Unetched, X100. Right—Unetched, X500.

shown in Fig. 5. The photomicrographs at 100, 500 and 1000 magnifications indicate that the structures of the plates were sufficiently similar to give comparable welding tests. Other tests have shown that the hardness of test plates does not influence the hardness of the welds produced by the alloy coated cast-iron rod. Through the medium of the coating, carbon and silicon are added in such amounts that the weld is always soft and machinable.

The metal welded using the steel rod is characterized by the fineness of its graphite and the fine lamillar pearlite. Its Brinell hardness of 225 indicates its close structure. The test plates used with the bare cast-iron rod weld have a coarser graphite structure with massive pearlite. While the chemical analyses of the two plates are probably nearly the same, the Brinell hardness of 228, and the microstructure, indicate that it was slowly cooled. The test plates welded with the alloy coated rod were soft, with a Brinell hardness of only 126, and were ferretic. The almost complete absence of pearlite, and the large, coarse graphite flakes in the ferrite account for this low Brinell hardness.

When cast iron is electrically welded, the metal immediately adjacent to the weld is heated to its softening point. Some carbon is dissolved, and upon cooling, cementite is again formed, and pearlite reformed. The rate of cooling, and the analysis of the iron controls the structure and hardness of this zone. In Fig. 6, the cast iron increased in hardness next to the weld when heated during welding with the steel rod. The graphite flakes are smaller than before welding, and the pearlite is poorly formed, with fine laminations. The metal adjacent to the weld made with the bare cast-iron rod became slightly softer. The graphite remains nearly the same, and the pearlite similar. The highly ferritic iron, welded with the alloy coated rod, was made somewhat harder due to the formation of some pearlite. The graphite was not so massive, and the matrix was approximately fifty per cent pearlite and fifty per cent ferrite.

The lines of fusion of the welds are shown in Fig. 7. Only the weld metal made with the alloy coated rod shows any graphite in the weld at the line of fusion. The weld made with the steel rod shows some porosity and oxides. The porosity at the line of fusion of the weld made with the bare cast rod is typical of the results obtained with this rod. The weld metal shows no graphite formation, and the Brinell hardness tests show the metal to be cementitic. The fusion line made with the coated rod shows no quick change to hard brittle metal. The line of fusion contains graphite in a finely dispersed state.

Great differences in the microstructures of the weld metals are seen in Fig. 8. The weld metal made with the steel rod shows some oxides in a matrix of poorly defined pearlite, and some massive cementite. The weld made with the bare cast rod shows no graphite, only pearlite

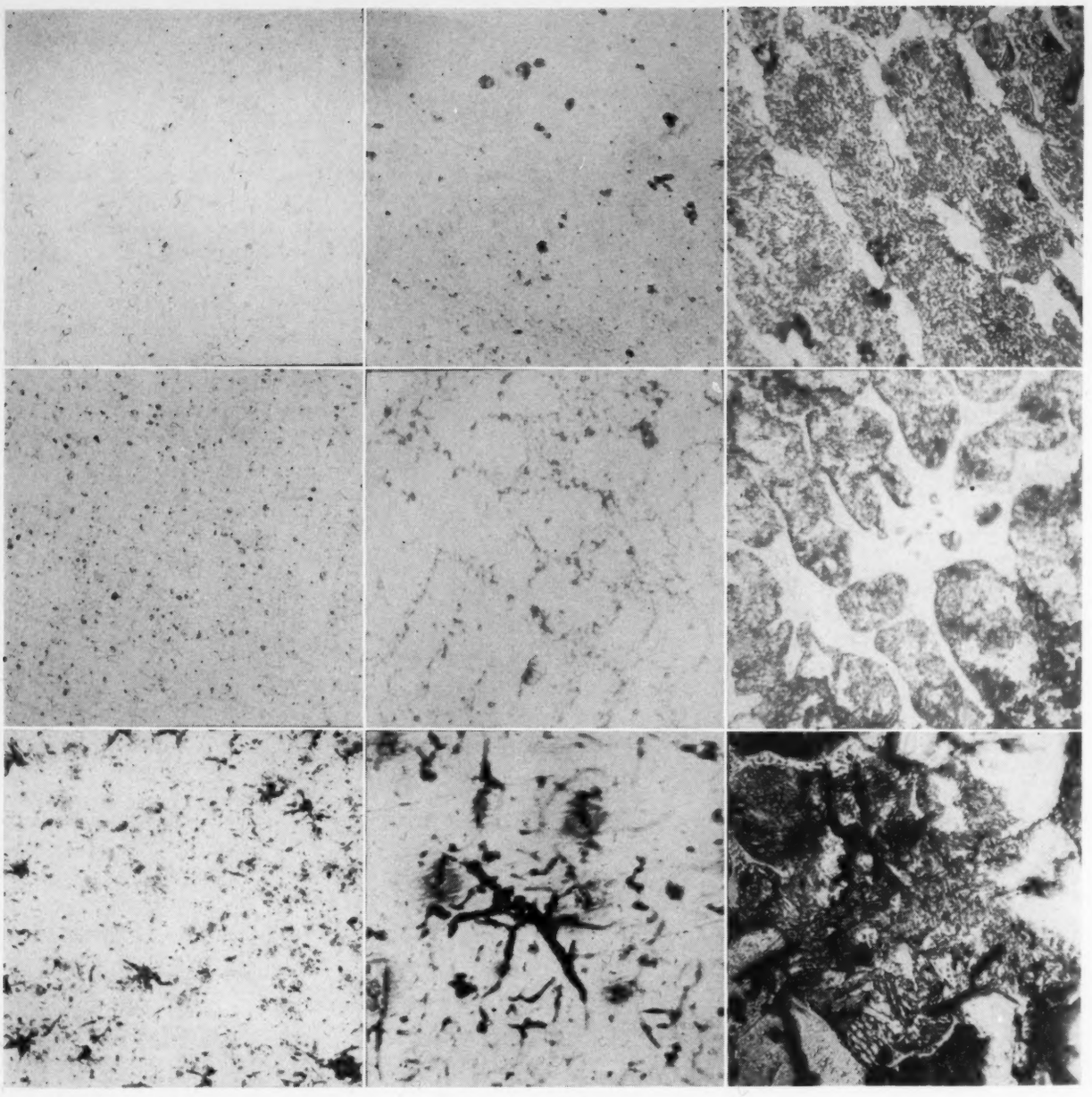


Fig. 8—Comparison of Weld Metal Microstructures Made with Different Metallic Electrodes.
Top Row—Steel Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.
Center Row—Bare Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.
Bottom Row—Alloy-Coated Cast Iron Rod. Left—Unetched, X100. Center—Unetched, X500. Right—Etched with Picric Acid, X1000.

and cementite. Very fine graphite is seen in the weld produced with the coated cast-iron rod. The matrix of pearlite shows it to have a close structure, of high strength.

Summary

Successful welding presupposes that the weld will have the same strength and physical properties as the metal being joined by the operation. The use of a steel rod for welding cast iron is therefore not recommended. The use of the cast-iron rod, with the proper coating that produces a gray, machinable weld, is good welding practice. This coating leaves no slag that must be removed in case multiple passes are required to build up broken machine parts. Thus it functions as a nearly perfect welding rod for either A.C. or D.C. operation.

West Coast Chapters Invite Speakers from the East

THE Association office has been asked to cooperate with the Southern and Northern California Chapters in assisting in obtaining speakers from the midwestern and eastern foundry centers. Members who know of others planning to visit the Pacific coast this year are requested to send this information either to the Association headquarters, or to the secretaries of the two chapters involved, namely, W. F. Haggman, secretary, Southern California Chapter, P. O. Box 615, Huntington Park, Calif., and G. L. Kennard, secretary, Northern California Chapter, 304 Rialto Bldg., San Francisco, Calif.

John A. Penton

1862-1940

THE death of John Augustus Penton on September 8 at his Santa Barbara, Calif., home, brought to a close the career of a man who had more to do with the formation of the American Foundrymen's Association than any other one person. As editor of *The Foundry,* which he organized in 1892, he had been an enthusiastic supporter of the few foundry associations then in existence. In October, 1895, when a national association was first advocated, he gave his enthusiastic support to the movement and through the pages of *The Foundry* urged attendance at a meeting in Philadelphia in 1896 called to organize a national foundry association. Mr. Penton introduced and succeeded in having passed the resolution forming the American Foundrymen's Association and was elected the first secretary, a position he held for three years. Continuing his interest in the Association, he, with three other early officers, donated funds to this organization which are used for the major medal awards, one being known as the John A. Penton Gold Medal of the American Foundrymen's Association.

Mr. Penton's contributions to the Association can probably be no better expressed than by repeating the resolution passed by the Association in 1934 on the occasion of the "Old Timers'" dinner at the annual convention, as follows:

"To John A. Penton—
Friend and Counsellor of Foundrymen:

Two score and two years ago you brought to the inarticulate American foundry industry a vision of national unity. As founder, editor and publisher of *The Foundry* you emphasized the bond of common interest existing among foundrymen and inspired them to consider the advantages of cooperating for their mutual benefit.

Through printed page and by virtue of your contacts with thousands of acquaintances in every community where castings were poured you contributed more than any other individual to the creation of an inspired industry consciousness. Later, when this newly born spirit culminated in plans for the first national meeting of foundrymen in Philadelphia, you voluntarily, unofficially and at your own expense, stimulated widespread interest in the event, insuring the representative attendance which made possible the founding of the American Foundrymen's Association. During the first year of its existence, as secretary, you nursed the organization through its most critical period, serving virtually as executive officer and board of directors.

For this conspicuous service to the industry, for your unwavering interest and support to the American Foundrymen's Association from the date of its founding, and for the inspiration you have given to thousands of foundrymen everywhere, the American Foundrymen's Association, by the unanimous action of its board of directors, desires to record its enduring esteem and appreciation.

Frank J. Lanahan, *President*
C. E. Hoyt, *Secretary."*

Philadelphia, October 22, 1934.

Mr. Penton, at the time of his death, was chairman of the Board, Penton Publishing Co., Cleveland, publisher of *The Foundry* and other business papers. He was born in Paris, Ont., May 12, 1862, attended the public schools at Sarnia, Ont., and then learned the trade of machinist and molder. He worked at the latter trade for a number of years in Canada and the United States, moving to Detroit in 1883.

While working as a molder, he was active in founding the Brotherhood of Machinery Molders and served that organization as president from 1882 to 1892. One of his accomplishments during that period was the establishment of a "Machinery Molders' Journal" of which he was editor. In 1892, Mr. Penton recognized the need of the foundry industry for a trade and technical publication, giving up his union activities to start *The Foundry,* the first issue of which appeared in Detroit in September of that year.

Later, in addition to being one of the chief organizers of the A.F.A., he was active in organizing the National Founders' Association, the National Metal Trades Association and the American Pig Iron Association. He served as a director of the National Conference Board from 1920 to 1928. He was appointed by President Harding as a member of the National Employment Conference held in Washington in 1921 and a member of the American Iron and Steel Institute and the Iron and Steel Institute of Great Britain.

In 1919 he was decorated by the French government with the insignia of the Order of Reconnaissance, Francais, Premier Classe; was made a chevalier of the Legion of Honor in 1921 and an officer of the Legion of Honor in 1926, honors bestowed in recogntion of diplomatic service during the World War.

Development of Some Gating and Feeding Methods For High Duty Alloys—I

By A. E. Cartwright* and C. C. Brisbois†, Montreal, Canada

This following article was published in June 13, 1940, FOUNDRY TRADE JOURNAL as the 1940 official exchange paper from the American Foundrymen's Association to the Institute of British Foundrymen. A. E. Cartwright and C. C. Brisbois, authors of the paper, are metallurgist and foundry superintendent respectively, The Robert Mitchell Co., Ltd., Montreal, P. Q., Canada. The authors, in the first part of the paper, present some experiences they have had in gating and feeding methods for high-duty alloys. They discuss direct riser pouring and direct-pour feeding head casting, giving information as to how these methods can be used in modern day foundry work. The second and concluding section will appear in the November AMERICAN FOUNDRYMAN.

THE energetic development of high duty alloys that has taken place during recent years, while being a tribute to the enterprise and ingenuity of the metallurgist, has taxed considerably the resources of the foundryman required to produce castings embodying the enhanced qualities implied by the results of metallurgical research.

The foundry and metallurgical technique requisite for the production of sound, dense castings in the modern high test and alloyed irons, for example, is much more exacting than that which was required in other days for cast irons. Higher pouring temperatures are the general order, and dictate the use of more refractory molding sands. High liquid shrinkage and short freezing range of the low-carbon, high strength gray irons, 'Ni-resist,' 'Ni-hard' and similar alloys, demand more generous feeding measures than the gray iron foundryman was previously accustomed to provide.

A steadily increasing demand for castings of these types of alloys argues that they are performing satisfactory service. Whether methods of producing them are universally such as to utilize to the fullest extent the metallurgical improvements that have been demonstrated, is possibly debatable and a subject worthy of consideration by those interested in their promotion. It is not sufficient that these modern alloys should furnish some additional service value over that of material previously used; for true progress one must aim for the ultimate properties possible of attainment from alloy concerned. That this attitude has been taken by many pioneering producers of these alloys is certain; otherwise, regardless of the improved metallurgical qualities and higher properties obtainable in test bars, such marked success, in competition with other metals and methods of fabrication, could not have so far been attained or maintained.

Fig. 1—Bottom parts of molds for the dies of Figs. 3 and 4. Vents appearing at one end of each mold are not to be mistaken for ingates.

It is recognized that discrepancy unavoidably exists between the mechanical properties of casting sections and those obtained from a standard test bar, owing to the diverse structural characteristics produced by differences in cooling rates occurring in the varying designs of castings. However, it is essential that the foundryman should take all precautions against this discrepancy being widened by porous discontinuities produced by inadequate feeding. In the authors' experience, gating and feeding proportions may be such as to provide a minimum or maximum density in a casting, above the range where rejection, due to visible defects, occurs. Minute porosities, resulting from minimum feeding provision, will usually be reflected in lowered strength and lessened resistance to wear, abrasion, cavitation and corrosion.

A number of variables are present when planning the proportions and location of gates and feeding heads for an unfamiliar design of casting. In foundries engaged in quantity repetition work, it is feasible to determine, on a trial basis, the most effective and economical molding technique for a particular design, before going ahead with production. This process is not, of course, practical where the miscellaneous jobbing foundry is concerned, except in minority instances, where a large number of castings from one pattern design are required.

The methods described in the present paper were evolved to meet the requirements of the extremely miscellaneous jobbing foundry with which the authors are concerned. Experiments were initiated about 4 years ago with the object of reducing the sensitivity to the variables prevalent in ordinary methods of gating castings weighing from a few ounces to two tons, made in both ferrous and non-ferrous alloys. These castings were made from

*Metallurgist, The Robert Mitchell Co., Ltd.
†Foundry Superintendent, The Robert Mitchell Co., Ltd.

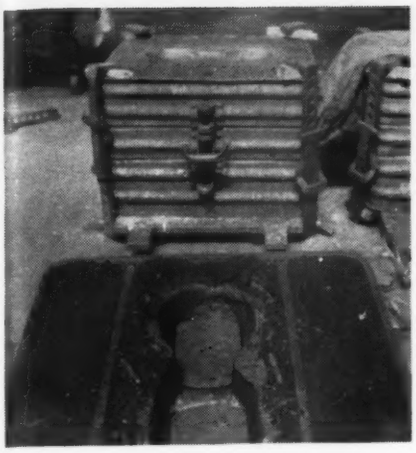


Fig. 2—Closed molds for the same dies with strainer cores in place.

various tin bronzes, brasses, manganese and aluminum bronzes, silicon bronze, nickel silvers, monel, and commercially pure nickel, as well as the alloyed irons mentioned above.

General Gating and Feeding Practice Consideration

While innumerable variations of gating and feeding of castings are practiced by different foundries, the almost universal method is to run castings by introducing the molten metal through one or more gates and to take care of shrinkage by use of feeding heads. Adequate feeding is sometimes accomplished by means of the gate itself, but when heavy sections are involved and more than a very moderate amount of feeding is required, separate feeding heads usually are employed. Such heads, more often than not, represent the last portion of the mold to be filled upwards from the casting, and, therefore, must be so proportioned as to provide feeding metal of sufficient quantity and fluidity to take care of the shrinkage requirements of the casting sections.

A number of supplementary methods frequently are employed to attain and maintain the required fluidity of the metal in the feeding head, *e.g.*, (a) interrupting pouring through the gate at a point where the mold cavity is filled and transferring pouring directly into the riser, and (b) connecting the downsprue with the base of the feeding head at a point where the mold cavity is full. Covering the head with powdered charcoal or other compounds furnishing an exothermic reaction, introducing a small amount of phosphor-copper (in the case of some bronzes), the use of feeding rods, etc., are all methods used to increase feeding head efficiency.

The obvious method of dispensing with a separate introductory gate and pouring directly and entirely through the feeding head is seldom seriously considered. To use the last mentioned method, it is necessary to ensure that the metal entering the mold is thoroughly free from dross or slag, and also to provide a mold surface that will resist satisfactorily the impact of falling metal. This latter condition commonly is considered sufficiently difficult to discourage the use of that method of introducing the metal. The methods herein described and illustrated were planned to overcome these seeming difficulties and to render the pouring of molds through feeding heads a practical and worthwhile procedure for many designs of castings.

Existing References to Direct Pouring Methods

Dwyer[1] illustrates and briefly describes a system of direct pouring through a strainer-feeding head, attributing the original idea to an Italian foundry engineer, Brunelli. Ronceray[2] likewise credits Brunelli with the initial recommendation. However, Ronceray can be particularly identified with the promotion of the idea through several papers read before European and American foundrymen[2, 3, 4].

The late George Batty described a method of arriving at similar results by bottom gating into feeding heads placed at low levels and, subsequently, partly or wholly reversing the mold position, so that the hottest metal is in the correct relative position for effective feeding[5]. This process may be practicable under certain standard conditions of production but is a rather terrifying prospect for the average jobbing founder.

Preliminary Studies

Initial consideration was given to choice of available molding sands best suited to withstand expected severe conditions. Practical trials were made to determine the most efficient basic form of feeding heads to accentuate the expected advantages of the method of direct head pouring.

Co-operative efforts of the metallurgist and practical foundryman were, of course, essential at every stage of the experiments. Critical comparative study of fractures and metallurgical structures was a prime means of evolving basic feeding head designs. Laboratory and practical foundry tests of sands and bonding agents were of importance, as also were thermal tests indicating the relation between actual pouring temperatures and the temperature of the metal in the mold at the end of pouring.

These data, considered along with freezing ranges of various alloys, indicated the improvements available by lowering the degree of superheating of the molten alloys necessary for optimum results. Intelligent revision of molding technique to suit the conditions, economical planning of existing equipment, and the addition of a minimum of

[1]Dwyer, P., *"Gates and Risers for Castings,"* Penton Publishing Co., Cleveland, O.
[2]Ronceray, E., *"The Making of Castings Without Feeding Heads,"* PROCEEDINGS, Institute of British Foundrymen, vol. 15, 1921-22.
[3]Ronceray, E., *"Facts About Sound Castings, Feeding Heads, Runners and Venting,"* PROCEEDINGS, Institute of British Foundrymen, vol. 16, 1922-23.
[4]Ronceray, E., *"Some Considerations in Gating and Pouring Castings,"* TRANSACTIONS, American Foundrymen's Association, vol. 38, pp. 41-64, 1930.
[5]Batty, G., *"Controlled Directional Solidification,"* TRANSACTIONS, American Foundrymen's Association, vol. 42, p. 237, 1934.

Fig. 3—Dies before risers are removed.

Fig. 4—A group of feeding head-poured dies of high tensile, nickel-chromium iron having a tensile strength of 25 tons per sq. in.

new essentials, perseverance in overcoming various minor obstacles, and, not least, tact in obtaining the co-operation of the conservative molder in efficiently handling the less usual materials and methods, were all matters requiring careful attention.

Advantages Obtainable by Direct Riser Pouring

It was increasingly demonstrated that, properly applied, the principle of direct riser pouring was capable of providing the following advantages:

(a) Much enhanced effectiveness of feeding by having the feeding head filled last with hottest metal, and maintenance of feeding head temperature by virtue of the head being covered with a heated strainer core.

(b) A moderate economy in feeding metal and gates, together with a large economy brought about by reduction in the number of defective castings.

(c) Much lessened sensitivity to feeding head proportions for different casting designs and alloys of different shrinkage characteristics; that is, the feeding head is generally of a size to compensate for a range of shrinkage wider than that provided for by the more usual methods.

(d) Generally lower requisite pouring temperatures for all alloys, with corresponding less necessity for excessive heating of the molten alloy. The last is an especially attractive feature from the metallurgical standpoint where those alloys most susceptible to oxidation or gas absorption beyond their melting point are concerned.

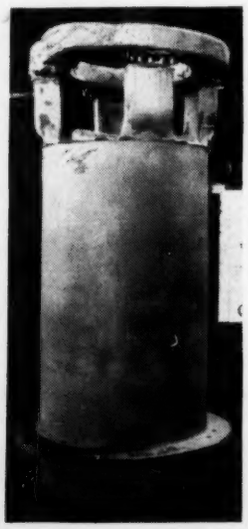


Fig. 5—Method used to produce a coil wire annealing pit in a heat-resisting, nickel-chromium cast iron.

Design of Direct-Pour Feeding Head

The basic design of feeding head chosen was that of a straight-sided, round-shouldered, short-necked bottle. The total height and diameter are variable, according to the size of section to be fed and the alloy concerned. The following principles of proportion are adhered to as closely as possible:

(a) The diameter of the base (neck) of the feeding head adjoining the casting should be not less than one-half the full diameter of the head, and,

(b) The full diameter of the feeding head should be continued downward to a point as near the casting as is consistent with maintaining a sufficient mold strength at the junction.

The importance of an efficient feeding head proportion and the general adaptability of a few sizes and shapes were considered sufficient to warrant making and maintaining a store of patterns. The riser pattern decided upon is handed to the molder along with the casting pattern. This eliminates uncertainties due to any misunderstanding on the molder's part as to the required feeding provision. Some of these patterns are made of wood; others are cast hollow in scrap aluminum. Plain cylindrical or square extensions are provided for varying height, and a core-print is provided for seating the strainer core used in all direct-pour heads.

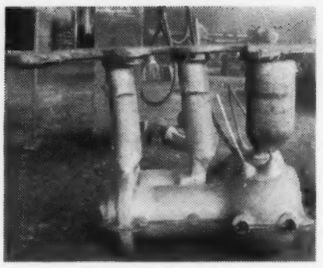


Fig. 7—A refrigeration pump that had been a constant source of heavy loss due to leakers when gated by other methods. The intenral design is complicated with abrupt changes of section. The direct-pour heads admit metal dropping directly on the complicated oil sand core which adequately resists this severity.

Fig. 6—A group of direct-head poured sludge pump parts in Ni-Hard (Martensitic White Iron).

For heavy solid work having flat backs, such as die blocks, such as shown in Figs. 1, 2, 3 and 4, the round bottled-shaped feeding head, unmodified in shape, is used. Varying casting designs, position and shape of cores, reinforcing bars in flask equipment, etc., frequently make necessary modification of the actual shape of feeding heads. The proportional dimensions are, however, adhered to as closely as possible. Other illustrations of castings on

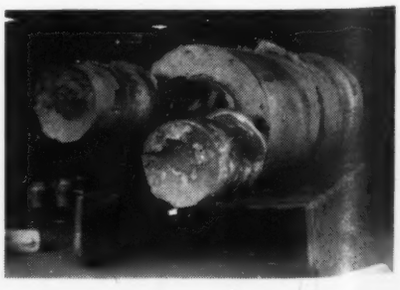


Fig. 8—A two-ton bushing with 6-in. wall in high tensile, nickel-chromium iron using two bottle design direct-pour heads.

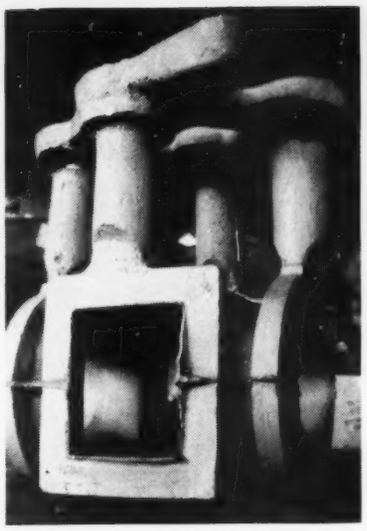


Fig. 9—A valve section in high tensile, alloyed iron.

which direct riser pouring was successful are shown in Figs. 5 to 13, inclusive.

Most of our earlier experiments were carried out with dry sand molding. This procedure was followed because the more expensive rejections concerned this type of work; that is fairly large castings of relatively heavy sections, and also because ordinary green sand mold surfaces do not satisfactorily resist the impact of molten metal falling from a height. It was found desirable to use a synthetic sand for the higher melting alloys, such as nickel alloys and alloyed irons. The fact that this sand is constantly available is the main reason that other alloys, perhaps not strictly requiring such a highly refractory sand, happen to have been cast in it. It is quite likely that, for ordinary bronzes, a natural sand would be sufficiently resistant to the pouring conditions. A fairly open sand is desirable (preferably one with a grain fineness number of 80 to 120 and with high permeability, a sand corresponding to A.F.A. coarse No. 3 or fine No. 4) and the mold should be well treated with a graphite wash to obtain good surface quality. In our practice, we lean generally toward sand permeability rather than use of a vent wire on a less open sand.

Synthetic Sand

The synthetic sand mixture chosen for direct riser pouring consists of a pure white silica sand bonded with 10 to 18 per cent bentonite. The heap sand gradually has been built up over a period of two years by preparation of a facing sand including about 20 per cent of new silica sand. When no increase in the quantity of heap sand is required, it is usual to prepare a facing sand from 100 per cent heap sand, 1 per cent bentonite being added.

Cereal Binders

The addition of 2 to 5 per cent cereal binder is made to the facing sand. This combats the tendency towards surface drying and crumbling generally associated with synthetic sands. The cereal binder is very efficient in maintaining plasticity without leaving behind undesirable fine material of bond destroying qualities when it burns out, a difficulty we have sometimes experienced when using, for example, sea coal.

Mechanical Analyses

The sand, as will be seen from mechanical analyses of Table 1, is very resistant to grain changes and to reduction to fine material. Sand losses are confined to average burning-out of bond and to relatively small amounts of sand adhering to castings going to the cleaning room. The quantity of water used throughout is about 10 per cent. A typical analysis of new silica sand and, for comparison, analyses of facing sand and heap sand are given in Table 1. The analyses of Table 1 are of new silica as received, and of facing and backing sand after bonding material had been washed out.

Working Characteristics

The sand mixture is not readily workable for hand ramming

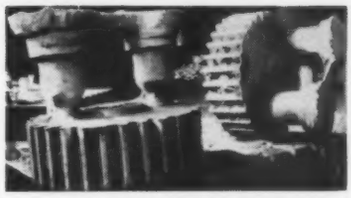


Fig. 10—Large gears in high tensile iron, unmodified bottle heads.

of molds. All molds made of this sand are rammed with an air rammer. The sand mixture is rather sticky, and difficulty, at first, was experienced in withdrawing the pattern, but this difficulty was overcome by spraying the pattern with a light fuel oil before the mold was rammed.

Notwithstanding the coarse grade of sand used, a very fine surface is obtained on castings when the mold surface is protected by a wash of the following mixture applied by air spray before the molds are dried:

Plumbago ..... 15 qt.
Glutrine ..... 1 qt.
Diluted with water to 24° Be'

Use of Strainer Cores

Strainer cores perform the very important function of providing clean metal to the molds and are used in the top of the feeding heads. These cores are made of a strong oil-sand mixture and in standard diameters ranging from 2 to 10-in. They vary in thickness from ½ to 1½-in. as the diameter of the core increases. The number and size of the holes in the strainer cores vary according to the job, generally from 4 to 12 holes of ¼ to ½-in. diameter being used. Except when it is required to avoid striking a centrally located core, the gate holes are arranged near the center of the strainer core. Care is exercised in all cases to avoid metal striking directly on

Table I

COMPARISON OF MECHANICAL ANALYSES OF NEW SILICA, FACING AND HEAP SANDS

Retained On	*New Silica, Per Cent*	*Facing Sand, Per Cent*	*Heap Sand, Per Cent*
No. 6 mesh	Nil.	Nil.	Nil.
No. 12 mesh	Nil.	Nil.	Nil.
No. 20 mesh	2.7	2.9	2.6
No. 30 mesh	21.5	17.6	14.1
No. 40 mesh	27.6	21.6	19.4
No. 50 mesh	25.6	14.8	16.5
No. 70 mesh	14.1	11.4	13.2
No. 100 mesh	6.1	8.4	10.4
No. 140 mesh	1.4	4.5	3.6
No. 200 mesh	0.3	3.2	3.4
No. 270 mesh	0.2	2.2	2.1
Pan mesh	0.5	3.5	4.3

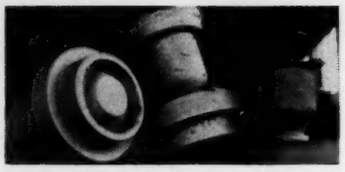


Fig. 11—Oil refinery castings in "Ni-Resist" (austenitic nickel-copper-chromium cast iron).

the protruding sand section at the riser-casting junction.

Direct Riser Pouring

For the past two years direct riser pouring has been successfully adapted to sand slinger molding and much of the work previously made in dry sand has been transferred to the sand slinger. The sand mixture, both heap sand and facing sand, used for sand slinger practice, is identical with that described for dry sand molding, with the exception of moisture content, which is controlled for sand slinger, between 4 and 6 per cent. All this work is skin-dried with a portable fuel oil torch.

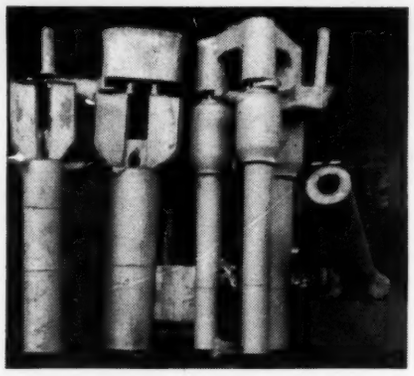


Fig. 12—Solid and cored bushings in monel metal.

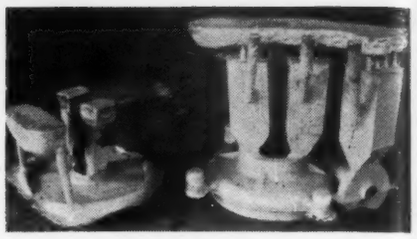


Fig. 13—A commercially pure nickel pump casing direct-head poured. Small impeller at left has conventional gating.

It should be noted here that, owing to restrictions of space and sand handling and preparing equipment, the amount of bentonite used is rather larger than would be necessary without these limitations.

(To Be Continued)

Foundrymen To Take Part in Safety Congress

ON Tuesday, October 8, during the 29th National Safety Congress, which will be held in Chicago, an interesting session on "Safety in the Foundry" will be presented with papers by members of the A.F.A. who have been active in the association's Safety and Hygiene section work.

John H. Holzbog, personnel director, Chain Belt Co., Milwaukee, Wis., and chairman of the Foundry Committee of the Metal Section, National Safety Council, who arranged the program, will open the meeting and introduce the presiding officer, Lamar S. Peregoy, president, Sivyer Steel Casting Co., Milwaukee, Wis.

L. C. Wilson, general manager, Reading Steel Casting Division, American Chain and Cable Co., Reading, Pa., will discuss "Ways and Means of Approaching and Maintaining the Safety Interest of the Supervisory Force and the Foundrymen; the Value of Executive Contact; Value of Contests, Posters, Stunts and Similar Features; What It Means to Maintain Interest and How It Might Affect Production and Costs."

Peter E. Rentschler, president, Hamilton Foundry & Machine Co., Hamilton, Ohio, will explain how to build a safety program for a small foundry. He will discuss "The Small Foundry's Problems; What Organization Plans Are Most Effective; What Activities Are Most Beneficial and What Results Can Be Expected; What Executive Support Is Required and How It Should Be Maintained."

L. S. Peregoy

J. H. Holzbog

L. C. Wilson

P. E. Rentschler

Foundrymen to Meet at Baltimore

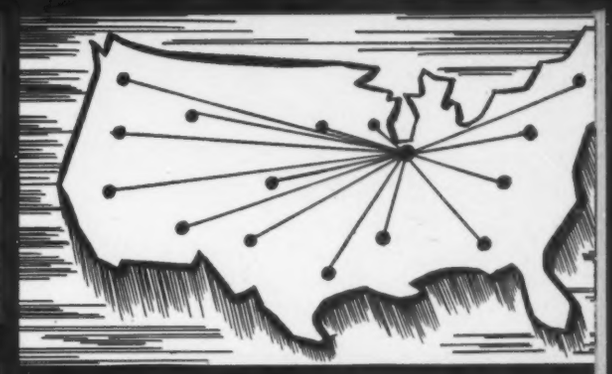
AN EVENT of great significance to the foundrymen of the Maryland - Washington, D. C. - Virginia district will be the meeting to be held the evening of Monday, October 14, at the Lord Baltimore Hotel, Baltimore. All foundrymen of the area are invited to attend as one of the purposes is to consider the formation of an A.F.A. chapter.

Following a get-together dinner, a technical address will be given by L. P. Robinson, Werner G. Smith Co., Cleveland. Mr. Robinson, an A.F.A. national director and past chairman of the Northeastern Ohio chapter, will discuss practical core room problems, a subject which he has so ably presented before many A.F.A. chapters and other foundry groups.

The meeting has been promoted by a committee of A.F.A. members under the direction of E. W. Horlebein, president, The Gibson & Kirk Co., Baltimore; R. T. Covington, fdry. supt., American Hammered Piston Ring Div., Koppers Co., Baltimore, and C. L. Frear, engineer of metals, U. S. Navy Dept., Washington, D. C. This movement for a chapter was stimulated by the Baltimore Regional Conference held last fall.

R. E. Kennedy, A.F.A. Secretary, will present to the meeting information as to the procedure to be followed in forming a chapter.

Chapter Activities



Ontario Chapter Holds Its Annual Picnic

By G. L. White*, Toronto, Ont.

ONTARIO chapter members and friends to the number of about one hundred and twenty participated in the second annual picnic at Barnesdale, the estate of Director Rolph Barnes, W. R. Barnes Company Ltd., Hamilton.

While the group of golfers played over the course of Watertown Golf and Country Club, the rest of the crowd took part in the shooting, horseshoes and dart games provided at Barnesdale. An outstanding feature of the entertainment was a display of aerobatics by two members of the Hamilton Aero Club who put their planes through a series of intricate maneuvers directly overhead.

Refreshments were served during the afternoon and a real picnic supper, with corn, husked and cooked on the spot, disappeared in record time.

Prizes which were awarded for golf, shooting, horseshoes, and the attendance draw, were war savings stamps and two sets of horseshoes, the latter donated by Diamond Calk Horse Shoe Company. Those who donated money for the purchase of war savings stamps were J. King, Werner G. Smith Company; H. S. Davis, A. P. Green Fire Brick Company Ltd.; E. H. MacInnis, E. F. Houghton Co. of Canada Ltd.; C. C. MacDonald, Frederic B. Stevens of Canada Ltd.; A. D. Hawthorne, Canadian Foundry Supplies and Equipment Company Ltd.; S. R. Francis, Metals & Alloys Ltd.; Rolph Barnes, W. R. Barnes Co. Ltd.; Norman B. Clarke, Steel Company of Canada Ltd.; Gordon Memory, North American Refractories Ltd.; Douglas Storie, Fittings Ltd.; John Reid, Canadian Westinghouse Company Ltd.; Russel Woods, George F. Pettinos Co.; D. J. Macdonald, Standard Sanitary & Dominion Radiator Ltd.; and J. Sully, Sully Brass Foundry Ltd.

Winners of the principal prizes in sports were as follows: golf, low gross, R. Palmer, Dominion Foundries & Steel Ltd.; low net, M. F. Cunningham, Cunningham & Son. W. R. Barnes, W. R. Barnes Co., Ltd., and C. Haas, Standard Sanitary & Dominion Radiator Ltd., won the prizes for the horseshoe pitching contest. In the shooting match first prize was awarded to J. Wilkinson, Jr., Wilkinson Foundry & Facing Co., while second prize was won by Bill Germond, Fittings Ltd.

A number of other prizes were awarded for each sport, as well as attendance prizes.

*Westman Publications, Ltd.

Sand Discussed at Cincinnati Initial Meeting

By Henry M. Wood*, Cincinnati, O.

CHAIRMAN H. F. McFarlin called the first regularly scheduled meeting of the Cincinnati chapter to order Tuesday night, September 10. Some 70 members had gathered at the Gateway restaurant to hear two speakers talk on the general subject of the meeting: Sand: Practical applications and selections of molding sand.

Ed. J. King, sales manager, Hill & Griffith Co., Cincinnati, chose as his subject, "Natural Bonded Sands." Norman J. Dunbeck, vice-president, Eastern Clay Products Co., Eifort, O., and the second speaker on the program, talked on "Synthetic Sands."

The papers presented were very interesting and instructive. They were limited to one-half hour apiece. The value of these papers and the beneficial manner in which they were received was shown in the discussions that followed their presentation.

*W. W. Sly Mfg. Co. and Secretary, Cincinnati chapter.

Scenes from Ontario Chapter Outing Showing Members and Guests Enjoying Themselves.

At the Southern California chapter outing. Top—Three past chairmen talk things over with the present chairman, J. E. Eppley. (Left to right) J. E. Eppley; Jack Coffman; A. G. Zima and Robert Gregg. (2) Scene from the tug-o-war. (3) Looking at the birdie (left to right) A. M. Barker; Charles Gregg; Dick Hughes; W. F. Haggman; Roy Barner and William Emmett. (4) Dick Hughes, chairman of the entertainment committee, and Chairman James Eppley drink a toast to the coming chapter year.

Buffalo Chapter Changes Name

IN A DESIRE to show the extent of its chapter's territory, the Buffalo Chapter recently, through action of its board of directors, and with the consent of the directors of the American Foundrymen's Association, changed its name to the Western New York Chapter.

Michiana Holds Second Annual Outing

STARTING its 1940-41 year with a September outing, the Michiana chapter can be congratulated on the success of this affair. Held on Saturday, September 14, at the LaPorte Country Club, LaPorte, Ind., over 300 were in attendance, a large increase over the attendance of the first outing last year.

The outing committee, under the chairmanship of V. C. Bruce, Buckeye Products Co., and vice chairmanship of W. V. Johnson, Oliver Farm Equipment Co., had made detailed arrangements for entertainment. The softball game was directed by Erick Gustafson, Sibley Machine & Foundry Corp., the ferrous ball team succumbing to the non-ferrous team in a hot contest. The bait casting contest and turtle races were directed by Joe Brajacki, Bendix Corp., the bait casting event proving popular in this territory, famed for its fishing enthusiasts. In the turtle races, some of the favorite entrants proved to be sluggish, though a few fast trotters gladdened the hearts of those who picked them as winners.

Ed. Bumke, Oliver Farm Equipment Co., chairman of the golf committee, had picked out a sporty course for the 130 or more who came early to play their favorite game. W. A. Bachman, New York Central Railroad, directed the horseshoe pitching contest, finding one member who proved that professional accuracy can be developed in the foundry. Several pairs of pitchers competed for the other prizes. R. E. Patterson, Elkhart Foundry & Machine Co., with his staff, handled the tickets and reservations to the satisfaction of all, the attendance being a tribute to Mr. Patterson's efforts. The evening was completed with an excellent dinner, a floor show and the awarding of prizes to the winners of the day's competitions.

Dr. Lorig Speaks at St. Louis Meeting

By J. W. Kelin*, St. Louis, Mo.

AT THE FIRST MEETING of the St. Louis Chapter, Chairman W. Carter Bliss, presiding, Thursday, September 12, held in the DeSoto Hotel, they had the largest attendance at any regular meeting held in recent years. The reason for such a gathering was to hear Dr. C. H. Lorig, Battelle Memorial Institute, speak on "Research and Development in Cast Metals."

Dr. Lorig spoke on developments in casting of metals. Steel, gray iron, malleable and nonferrous casting problems were considered and through the discussion period that followed the speaker led in a most interesting round table discussion of various problems presented.

Earlier during the meeting short "coffee talks" were presented by Morris M. Hanson and Taylor S. Custer, representing the Division of Labor Standards, U. S. Department of Labor. Their talks outlined briefly federal co-operation in apprentice training and the work of the Federal Committee on Apprentice Training.

A report of special interest was given by Carl Morken, Carondelet Foundry Co., concerning the training school committee. This elementary course, probably to be known as "Fundamental Foundry Form," is to embody a series of twelve lectures by local foundrymen on twelve Wednesday evenings beginning October 23. Following each lecture will be a period of one hour devoted to discussion of questions brought up in the talk. These meetings will be held at the Auditorium, Laclede Gas Light Co., St. Louis, and judging from advance interest displayed will be featured by an extremely large attendance.

*Federated Metals Division, A. S. & R. Co. and Secretary-Treasurer, St. Louis chapter.

Northern California Hears About Testing Materials

By G. L. Kennard*, San Francisco, Calif.

FRIDAY the 13th was no jinx for the Northern California chapter, for they started their year of monthly meetings with a bang in what was acclaimed as "the best yet." Ivan Johnson flew back from a business trip in the east to make his debut as chairman and welcome the members who turned out for the first meeting, which was held in the Alexander Hamilton hotel.

The program committee, under the direction of Jim Francis, gave a sample of what the chapter can expect during the year by presenting G. E. Troxell, Associate Professor and Assistant Director of Engineering, Material Laboratory, University of California, and an active member of A.S.T.M. Mr. Troxell chose as his subject the work of the A.S.T.M. in testing materials for the establishment of standards. He led his audience from the primary stage right through to the scientific stage, whetting their mental appetites to the point that a flood of questions followed.

*Secretary-Treasurer, Northern California chapter.

Pictures of the August 15, Detroit Chapter Outing at Tam-O-Shanter Country Club, Detroit. Left to Right—Top Row—Jesse Stoddard Drives Off. Glen Coley, Chairman; Al. Boegehold, Director; and Vic Crosby, Vice Chairman of Detroit Chapter. H. McCoy, Jack Jones and R. Cleland Pose for a Small Picture. Jim Jameson and George Brenner Peak Over at Us with A. Link and Mike Warchol Standing, Nonchalantly by. Center Row—Fred Walls, Director, and Bill Bowring, Treasure, Smile for the Birdie. Form Players, Which Will You Take, Jim Mahon's or Jesse Stoddard's Drive? E. G. Goss, G. A. Fuller, G. A. Alpeter Look Happy. A. H. Hay, R. S. Barnes and F. A. Mason, Ditto. Bottom Row—R. Clade Assumes the Posture in a Sand Trap. A. R. Crawford, R. M. McCabe, Les Korte and Babe Crawford Pose Before the Battle. R. Clade, Jim Mahon, M. Drennen and H. Bringhurst Pose "Barber Shop Quartet" Fashion.—(Photos, Courtesy F. A. Jensen, National Engineering Co.)

Apprentice Foundrymen's Course Discussed Before New England Meeting

By M. A. Hosmer*, Boston, Mass.

PRESIDENT Francis LeBaron presided over the September meeting of the New England Foundrymen's Association held at the Engineers Club, Boston, Mass. About 80 members attended their first meeting of the year.

After the dinner, President LeBaron called on Mr. Peterson, head, foundry department, Wentworth Institute, who extended an invitation to the association to meet at the Institute for their regular monthly meeting in October. This invitation was accepted and the next meeting will be held on October 9 at Wentworth Institute where an inspection of the school will be made. Mr. Peterson said that all departments would be in session at that time. Mr. Peterson further explained briefly an apprentice foundrymen's course being presented at Wentworth Institute at the present time under the auspices of the Federal Government and the State of Massachusetts. Twenty-two men were now undertaking the study of all phases of the foundry industry, including mixing and cutting molding sands by hand and machine and the charging and operation of a cupola. The course has been in progress approximately five weeks and is expected to continue for several weeks more. Six complete heats have been taken out up to the present time by the students and all work in connection with molding and pouring carried out by them.

Mr. Peterson stated that he thought this was the first work of its kind in the country including men of all ages, some from the WPA. He also stated that the purpose of the course was not to present industry with a finished molder or foundryman, but to offer the foundry industry men who had some knowledge of the foundry and who could be selected as offering possibilities for apprentices in the industry.

A thirty-minute sound film entitled "Foundry Progress" was then presented through the courtesy of the Modern Equipment Co., Port Washington, Wis. This proved to be a most interesting picture and showed in very fine detail the modern equipment of many prominent foundries in this country.

Mr. LeBaron expressed his appreciation to Robert Rehm,

*Chemist, Hunt-Spiller Mfg. Corp. and reporter, New England Foundrymen's Association.

Whitehead Bros. Co., for their courtesy in obtaining this film.

Through the courtesy of General Electric Co. a second film was given entitled "Iron Foundry Progress Through the Years." This proved to be very interesting and instructive, not only from the standpoint of seeing how we used to perform molding operations, but also in showing some of the latest methods of manufacturing molds. Henry Jensen and E. H. Ballard, General Electric Co., briefly commented on the film.

Northeastern Ohio Sees Movie

By Edwin Bremer*, Cleveland, Ohio

WITH President Ray Fleig presiding, activities of the Northeastern Ohio chapter opened auspiciously at the first fall meeting held at the Cleveland club, Cleveland, on Sept. 12, with nearly 125 members and guests present. The chapter was extremely fortunate in having two national directors present, namely, Henry S. Washburn, Plainville Casting Co., Plainville, Conn., past president and director, and Ben D. Claffey, General Malleable Corp., Waukesha, Wis., chairman of the Wisconsin chapter and A.F.A. director. Both spoke briefly and congratulated the chapter on its activities. Ray Redmond, Buckeye Foundry Co. and member of the Cincinnati chapter, also was present.

President Fleig then read a brief eulogy on the late John A. Penton, founder of *The Foundry*, chairman of the board of the Penton Publishing Co. and honorary member of the Northeastern Ohio chapter, in which he stressed Mr. Penton's lifelong efforts on behalf of the foundry industry which resulted in organization of the American Foundrymen's Association, National Founders' Association, etc., and led to the industry's high position in the industrial world.

Main feature of the meeting was the first showing of a new sound motion picture, titled "Sinews of Steel," photographed at the Bethlehem Steel Corp. It depicted the manufacture of wire rope, beginning with the ore and following the various phases until the finished product emerged.

*Metallurgical Editor, *The Foundry*, and chairman, Publicity Committee, Northeastern Ohio chapter.

Wisconsin Chapter Announces 1941 Regional Conference

THAT the Wisconsin chapter is on the job is seen by its announcement at this time of its Fourth Annual Regional Foundry Conference to be held at the Hotel Schroeder, Milwaukee, Wis., on Thursday and Friday, February 20 and 21. These dates and formal plans for the conference were decided upon at a meeting of the conference committee in Milwaukee, August 9. The conference committee anticipates an attendance in excess of 500. Final plans for the programs of sectional sessions and luncheons were perfected at a meeting of the committee on September 27.

Two sessions in each of the divisions, gray iron, malleable, steel and non-ferrous, will be held each morning and afternoon on both days, with a luncheon served at the hotel each noon. The conference dinner, for which an outstanding program is being planned, will be held following the afternoon sessions of the first day. The sectional chairmen are: *Gray Iron*, Harry Ludwig, Allis Chalmers Mfg. Co.; *Malleable*, Charles Gutenkunst, Milwaukee Malleable & Grey Iron Works; *Steel*, Paul Power, Maynard Electric Steel Casting Co.; and *Non-Ferrous*, Walter Edens, Ampco Metal Co.

The personnel of the conference committee is: A. C. Ziebell, conference chairman; Professor J. F. Oesterle, Wisconsin University; Ben D. Claffey, chapter chairman; David Zuege, R. F. Jordan, Harry Ladwig, Charles Gutenkunst, Paul Power, Walter Edens, George M. Pendergast, Roy M. Jacobs, William MacNeill, Walter Gerlinger, George Dreher, T. E. Ward, Howard Waldron, Harry Donald, Professor E. R. Shorey, Ray Flansburg, John Ring, James Ewens and Fred Pritzlaff.

The sub-committee chairmen are: *Speakers*, George Dreher; *Publicity*, George M. Pendergast; *Arrangements*, Roy M. Jacobs; *Registration*, William J. MacNeill; *Head Table Management*, Walter Gerlinger; and *Entertainment*, Ben D. Claffey.

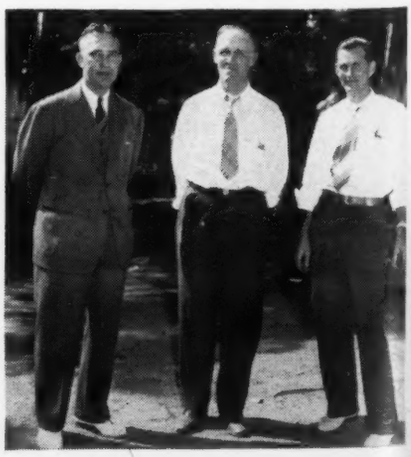
Foundrymen Enjoy Birmingham Outing

By J. B. Hayes*, Birmingham, Ala.

THE Birmingham District chapter held its fifth annual Bar-B-Q picnic at Pineview Beach, September 14. Approximately 540 turned out for the all-day affair, which was said to have been one of the best gatherings the chapter has ever had.

Lester N. Shannon was present at the meeting and added much to the party. The committee, under the chairmanship of Joe Gilbert, had made arrangements so that everyone present could follow his particular form of entertainment. There was a "slam bang" softball game, bowl-

*National Carbon Co. and chairman Birmingham District chapter publicity committee.



Three Birmingham chapter officers pose for the cameraman. (Left to right): J. A. Bowers, vice-chairman; W. O. McMahon, chairman, and D. L. Booker, secretary-treasurer.

ing, horseshoe pitching and boating. Barbecued chicken and spareribs were served at 1:00 o'clock and it certainly did taste good and hit the spot.

Afterwards the crowd gathered along the beach and saw an exhibition of diving and swimming. The various performers were amateur champions of the South and Southeast. They put on a swell show for the men and proved they really could cut capers in the water.

St. Louis District Chapter Lecture Course Outlined

PLANS for the St. Louis District chapter lecture course, a new venture, are practically complete. With weekly sessions, beginning Wednesday, October 23, the course will run over 12 weeks, with the instruction covering three sections: (a) Drawings, (b) Sands and Facings, and (c) Gating and Risering.

The lectures are to be given by experienced foundrymen, appealing to the apprentice as well as to the foreman, with registration open to non-members as well as members, at a nominal registration fee. Meeting room facilities are being donated by the Laclede Gas Light Co.

The schedule as tentatively lined up is:

October 23 — W. Carter Bliss, works mgr., Scullin Steel Co. and chapter chairman. "Removing the Mystery from the Blue Print."

October 30—Thos. H. Ross, David Ranken, Jr., Trade School. "Translating the Drawing to the Pattern Shop."

November 6—Roy A. Jacobsen, general supt., Carondelet Foundry Co. "The Drawing from the Foundryman's Point of View and Effect of Pattern Design on Foundry Production."

November 14—Lecture on "Sand Testing" with demonstrations of tests.

November 20—T. C. Hamlin, foundry supt., U. S. Radiator Co. "Natural Sands," including facings.

December 4—Lecture on "Synthetic Molding Sands," including base and bonding materials and applications.

December 11 — F. K. Riggan, metallurgist, Key Co. "What Happens When the Casting Freezes and Cools," covering steel and cast iron and explaining why feeding is necessary.

December 18 — C. B. Shanley, manager, Semi-Steel Castings Co. "Light Gray Iron Gating," giving factors in producing small gray iron castings.

January 8 — Roy A. Jacobsen, general supt., Carondelet Foundry Co. "Gating and Risering High Test Iron Castings."

January 15—"Gating and Risering Steel Castings." A discussion of the factors involved in producing sound, clean, accurate castings in carbon and alloy steels.

January 22—W. F. McKee, Key Co. "The Use of Chills for Controlling Shrinks in Castings." This will be a treatment of internal and external chills in iron and steel castings.

January 29—The last lecture of the series, "Molding Machines and Their Uses."

The development of the lecture course is under the supervision of a committee under the chairmanship of Carl H. Morken, Carondelet Foundry Co. Serving with him are Fred Riggan, Key Co.; Webb Kammerer, Midvale Mining and Mfg. Co.; Louis J. Desparois, Pickands Mather & Co.; J. W. Kelin, Federated Metals Div., A. S. & R. Co., and W. Carter Bliss, chapter chairman and works mgr., Scullin Steel Co. Affiliated with this committee is the apprentice committee, George Mitsch, American Car & Foundry Co., chairman, with C. B. Shanley,

Top row (left to right): Preparing the feast. (2) Come and get it. (3) With the greatest of ease. Bottom row (left to right): Four southern gentlemen wait for those barbecued spareribs. (2) Dishin' it out. (3) Looks like "duck pins" is a favorite sport down south. Center (left to right): Henry Noble, Wayne Nelson, Joe Gillbert, picnic chairman; J. A. Bowers, W. O. McMahon, A. C. Holbrook, Leck Shannon, national president; Dick Dess, and J. B. Hayes, chairman publicity committee.

Semi-Steel Casting Co.; Wm. McKee, Key Co.; Emil Goerger, City Pattern & Model Co.; Francis O'Hare, Central Brass & Aluminum Foundry Co.; R. A. Jacobsen, Carondelet Foundry Co.; T. A. Ross, David Rankin, Jr., Trade School.

Central New York Holds Annual Stag Picnic

By L. D. Wright*, Geneva, N. Y.

THE second annual stag picnic of the Central New York Chapter was held at the Utica Golf Club, Utica, N. Y., with 65 members and guests attending. Golf, baseball, horseshoe pitching, and other sports were enjoyed during the afternoon.

Ed Bair, chairman of the program and arrangements committee, and all his committee members saw to it that the men present had a good time and enjoyed themselves.

A southern fried chicken dinner was served at five o'clock in the dining room of the clubhouse. Frank Wheeler, Central New York chairman, arranged for the music, which was provided both by invited guests and members of the chapter.

Immediately after the dinner, a floor show was presented and this was followed by an exhibition of magic by Bob Thrasher.

*Secretary, Central New York Chapter and Supt., United States Radiator Corp.

Chapter Chairmen

P. A. Paulson, Northern Illinois-Southern Wisconsin

An active and enthusiastic supporter of the Northern Illinois-Southern Wisconsin chapter, since it was first organized, is newly elected chairman P. A. Paulson, metallurgist, Gunite Foundries, Rockford, Ill. Mr. Paulson was born, raised and received his elementary education in Rockford. He attended Augustana College, Rock Island, Ill., and was graduated from that college.

His first job, after getting out of school, was in South Chicago, Ill., at the Illinois Steel Co. as a chemist. A year later he returned to Rockford to take the position of chemist at the Rockford Malleable Iron Works. He then went to the west coast for a period of two years where he was employed as a chemist for one year, respectively, at the Pacific Malleable Castings Co., Oakland, and Warman Steel Castings Co., Los Angeles. The year 1929 found him back in Rockford associated with Gunite Foundries Corp. as a metallurgist, the position he now holds.

G. P. Phillips, Chicago Chapter

G. P. Phillips, elected chairman of the Chicago chapter for the forthcoming year, is a metallurgist, International Harvester Co., Chicago, Ill. Born in Prairie Creek, Ind., Mr. Phillips received his technical education at Rose Polytechnic Institute, Terre Haute, Ind., and at Carnegie Institue of Technology, Pittsburgh. Following the receipt of a master's degree from the Carnegie Institute, he accepted a position as metallurgist, Frank Foundries Corp., Moline, Ill. Later, he left there to accept his present position with the International Harvester Co.

Mr. Phillips is well known to the foundrymen of the country for his many contributions to A.F.A., especially in matters to do with alloy cast iron and the correlation of test bar results. Mr. Phillips is a member of A.F.A., A.S.M. and A.S.T.M.

James E. Eppley, Southern California Chapter

Meetings of the Southern California chapter will be presided over this year by James E. Eppley, superintendent, Kinney Iron Works, Los Angeles. Mr. Eppley served as vice-chairman of this chapter last year.

Born in Fairmont, Ill., he received his education in the grade schools of that city. Following the completion of his formal education he served his apprenticeship at the Duncan Foundry, Alton, Ill. He then was employed by the John Deere Tractor Co., Waterloo, Ia., and was assistant superintendent until 1919, when he became associated with Montgomery-Ward & Co., Chicago, as a foundry expert. He then went back to Waterloo, Ia., as superintendent, Construction Machinery Co., until 1929. He was affiliated with the Badger Foundry Co., Racine, Wis., from 1929 to 1934 and then was employed by the Claffey Casting Co., Waukesha, Wis., until 1936. He left there to accept his present position with the Kinney Iron Works.

M. F. Doty, Michiana Chapter

M. F. Doty, manager casting division, Clark Equipment Co., Buchanan, Mich., was elected to head the Michiana chapter for the forthcoming year. Mr. Doty was born in Hartford, Conn., and attended public schools and high school in Hartford. He attended Columbia University, New York, N. Y., and was graduated from that school. In 1905 he acquired the job of cost accountant with the Lukens Steel Co., Coatesville, Pa.

(Continued on Page 21)

P. A. Paulson

G. P. Phillips

J. E. Eppley

M. F. Doty

NEW MEMBERS

Birmingham Chapter

A. M. Garrison, Jr., Stockham Pipe Fittings Co., Birmingham, Ala.
Sam F. Teague, Jr., Chemist, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.
Somerville Iron Works, Chattanooga, Tenn.*
G. T. Walker, Jr., Foreman, Stockham Pipe Fittings Co., Birmingham, Ala.

Central Indiana Chapter

Frank J. Miller, Indianapolis, Ind., Salesman, Carborundum Co., Niagara Falls, N. Y.

Chicago Chapter

Frank Piatt, Chicago, Ill., Vice President, Mexico Refractories Co., Mexico, Mo.

Cincinnati Chapter

Hamilton Brass & Aluminum Castings Co., Hamilton, Ohio (Chas. E. Koehler, Treas.)*
Jackson Sand Mining Co., Jackson, Ohio (Corwin Matthews, Sales Mgr.)*
Oberhelman-Ritter Foundry Co., Cincinnati, Ohio (Harold Ritter, Co-Owner)*
Ferdinand F. Rotrock, Methods-Engineering, Cincinnati Milling Machine Co., Cincinnati, Ohio
Standard Castings of Cincinnati, Inc., Cincinnati, Ohio (J. E. Fuqua, Vice President)*
George Wilson, Jr., Salesman, S. Obermayer Co., Cincinnati, Ohio

Northern California Chapter

Paul G. Jordan, Asst. Supt., Vulcan Foundry Co., Oakland, Calif.

Southern California Chapter

Victor P. Barton, Vice President, Triplett & Barton, Inc., Burbank, Calif.
M. E. Greenhow, Supt., Federated Metals Div., American Smelting & Refining Co., Los Angeles, Calif.
Melvin Hanselman, Fdry. Foreman, Kay-Brunner Steel Products, Inc., Alhambra, Calif.

Metropolitan New York-New Jersey Chapter

Robert E. Ward, Met., Eclipse Aviation Div., Bendix Aviation Corp., Bendix, N. J.
Clinton Forsyth Zabriskie, Tech. Asst., Wright Aeronautical Corp., Paterson, N. J.

Michiana Chapter

M. S. Anderson, Plant Chemist, Michiana Products Corp., Michigan City, Ind.
H. E. Ardahl, Michiana Products Corp., Michigan City, Ind.
Mathieu & Sons Foundry Co., Bridgman, Mich. (Jos. Mathieu, President)*

Northeastern Ohio Chapter

Willis R. Hale, Sales, Scientific Cast Products Corp., Cleveland, Ohio
Melville E. Kohler, Sales, Scientific Cast Products Corp., Cleveland, Ohio
Scientific Cast Products Corp., Cleveland, Ohio (Willis W. Hale, President)*

Philadelphia Chapter

J. H. Hucker, Philadelphia, Pa., Sales Engineer, American Air Filter Co., Louisville, Ky.
P. L. Pryibil, Philadelphia, Pa., Sales Engineer, American Air Filter Co., Louisville, Ky.

St. Louis Chapter

Chas. F. Gilbert, Jr., President, Gilbert Brass Foundry Co., St. Louis, Mo.

Wisconsin Chapter

Wm. H. Brooks, Foreman Fdy., Allis-Chalmers Mfg. Co., West Allis, Wis.
William Buckholtz, Belle City Malleable Iron Co., Racine, Wis.
Clifford A. Chier, Sales, C. A. Chier Sand Co., Milwaukee, Wis.

Outside of Chapters

I. H. Adams, Asst. Fdry. Supt., Lynchburg Foundry Co., Lynchburg, Va.
Harry E. George, Koppers Co., American Hammered Piston Ring Div., Baltimore, Md.
M. V. Healey, General Electric Co., Schenectady Works Laboratory, Schenectady, N. Y.
James M. Kelly, Research Met., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Francis S. Kleeman, Fdry. Development Engr., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Chas. V. Knobelock, Koppers Company, Bartlett-Hayward Div., Baltimore, Md.
Nick Odorisio, Fdry. Supt., Omaha Steel Works, Omaha, Neb.
John J. Pendergast, Asst. to Supt., General Electric Co., River Works, Lynn, Mass.
Marshall G. Pulsford, Fdry. Foreman, General Electric Co., Everett, Mass.
Ruben Veloso V., Mechanical Engr., Chilean Railways, Santiago, Chile.

*Company Members.

(Concluded from Page 20)

The Isaac G. Johnson & Co., Spuyten Duyvil, N. Y., was his next employer, in 1909, where he worked as sales and production manager until 1917. He performed in a similar capacity with the Michigan Steel Casting Co. until 1920, when he went to the Melvin Doty Co., Detroit, Mich., as a sales engineer. In 1936 he became associated with the Clark Equipment Co., with whom he holds his present position, manager of its casting division.

In addition to his membership in A.F.A., Mr. Doty is a member of such organizations as S.A.E. and the Steel Founders Society of America.

ABSTRACTS

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Aluminum

WELDING. *"Fluxes for Welding Aluminum,"* by E. G. West, *Foundry Trade Journal,* vol. 63, no. 1251, August 8, 1940, p. 88. One of the principal sources of trouble in the welding of aluminum and its alloys is the oxide film on the surface of the solid and molten metal. This film increases the apparent surface tension of molten aluminum, but there is doubt as to the exact extent of the change. Before starting to weld the surface should be thoroughly cleaned, mechanically or chemically. During the welding operation oxide formation is continuous and rapid and it is essential to remove the alumina before it is entrapped in the freezing metal. Fluxes in use today are essentially fluorides, chlorides and sulphates, carbonates or other salts of the alkali and alkaline earth metals. A list of the ideal requirements of a flux are shown along with the reactions involved. (Al.)

Castings

INSPECTION. *"Castings Must Pass Many Tests,"* by M. D. Johnson, *The Foundry,* vol. 68, no. 9, September, 1940, pp. 28-33, 108. The inspection department should be considered a service department as it safeguards the quality of the product. There should be as much cooperation as possible between the machine shop and foundry, which is not very easy to accomplish. In order for such a relation to exist the foundry and machine shop should belong to the same organization and located close together. The point stressed by the author is that the smaller and more detail items in foundry work can cause as much damage as the major defects. The visual inspection of castings should be stressed and developed most. The chalk and oil method and light paint spray method for detecting cracks is discussed. A few of the simple fixtures used in determining unsound castings are mentioned. (C.)

Cast Iron

GLASS MOLDS. *"Glass Molds Present Many Problems,"* by R. M. Scafe, *The Foundry,* vol. 68, no. 9, September, 1940, pp. 36, 101-103. At present the tendency in the production of glass molds is toward the use of comparatively small amounts of one or more alloys. What effect such alloys as chromium, nickel, copper, molybdenum and vanadium has on mold qualities is discussed. Titanium can be used as a deoxidizer and in this way improves the physical properties. Melting processes are also related. (C.I.)

PEARLITE. *"Decomposition of Pearlite in Gray Cast Iron,* by A. A. Timmins, *Foundry Trade Journal,* vol. 63, no. 1252, August 15, 1940, pp. 109-110. An investigation was conducted with a view to determining the conditions governing the decomposition of pearlite in gray cast iron. For this purpose two irons of similar composition, except for the silicon content, were obtained in the form of 1.2-in. diameter bars. Sections were cut from the bars and heated in a small electrically-heated tube furnace at 700 and 900°C. The conditions governing the annealing could be studied at temperatures above and below the critical point of the iron used. The effect of the heat-treatment is discussed in detail giving what conditions were found while conducting the test. Effect of soaking time was also discussed and shows that for temperatures below the critical point, the time occupied at the soaking temperature is of the greatest importance in removing pearlite. The author also relates of an attempt to study in more detail the rate of formation and decomposition of combined carbon in gray cast iron. (C.I.)

PEARLITE. *"Decomposition of Pearlite in Gray Cast Iron,"* by A. A. Timmins, *Foundry Trade Journal,* vol. 63, no. 1253, August 22, 1940, pp. 121-123. It has been shown in this article that the annealing of gray cast iron involving the decomposition of pearlite may be readily accomplished at temperatures below the critical point, and that in such cases the rate of cooling after heating is of little importance. The major factor in the removal of pearlite by a high-temperature anneal is the rate of cooling after the anneal, the slower the rate of cooling the greater being the amount of pearlite which is removed. Silicon does not appear to affect the rate of graphitization at constant temperatures. The results obtained have a great bearing on the commercial annealing of gray cast iron, the most important feature being that softening can be obtained most easily and more completely by annealing at temperatures near the critical point of the iron concerned. In most cases, the softening of cast iron for the production of easily-machinable iron is carried out in a haphazard manner and usually at temperatures above the critical point. (C.I.)

PROPERTIES. *"The Fatigue and Impact Strengths of Cast Iron,"* by J. W. Donaldson, *Foundry Trade Journal,* vol. 63, no. 1251, August 8, 1940, pp. 91-93, 96. This is a continuation of the work carried out by the author on the endurance properties of cast iron. Results have been obtained for recently developed high-duty and alloy cast irons, the effect of over-stressing and under-stressing cast iron has been more fully investigated and more data have been secured for the behavior of high-duty and alloy cast irons under combined stresses. Some interesting material is presented on combined fatigue stresses, impact testing and impact strength and notch sensitivity. (C.I.)

WELDING. *"Rebuilding Worn Cast Iron Surfaces," The Iron Age,* vol. 146, no. 10, September 5, 1940, p. 49. In the rebuilding of gray cast iron parts, soft, machinable welds are readily obtainable by careful procedure and attention to detail. Hard spots within the rebuilt areas must be avoided. How hard spots can be avoided and the proper method for welding gray cast iron parts is set forth in this paper. (C.I.)

Cleaning

CASTINGS. *"Grinding and Sanding Castings Without Dust," Iron Age,* vol. 146, no. 11, September 12, 1940, p. 51. The top of each working station is a large grating through which air is exhausted to quickly pull away the clouds of rust, sand and other fine particles, such as paint. Gratings are located at various levels in order that the men will never be in a position to inhale the dust or fumes, nor will they have to work in a bent-over position. Castings are transported from one department to the other by a dolly run on a rail system. The necessary units needed in the small castings grinding section are also related. (C.)

Cupola

MOISTURE CONTROL. *"Moisture Control for Cupola Combustion Air,"* by L. C. Mabley, *The Whiting Founder,* no. 23, Summer, 1940, pp. 3-5. Controlling the moisture content and temperature of cupola combustion air seems to be a subject of considerable interest these days. During the past few years the first dry plants used refrigeration to control moisture, a new step involved indirect refrigeration and still another method used solid chemicals for absorption. The idea of chemicals absorbing atmospheric moisture, however, was an excellent one if it were possible to use a liquid instead of a solid. Several years ago such a process was developed. This process employs an acqueous solution of lithium chloride which at normal temperature and strength has the ability to absorb large quantities of moisture from the air. (F.)

COMBUSTION. *"Technique of Combustion in a Cupola,"* by J. Goffart, *Foundry Trade Journal,* vol. 63, no. 1247, July 11, 1940, pp. 25-26, 28. The necessity of knowing the position of the zone of complete combustion in relation to the plane of the tuyeres is shown. It is upon this knowledge that the principles of the utilization of the cupola should be based. To prove this the tests in this experiment were made in a cupola of 27-in. internal diameter provided with four tuyeres 8-in. by 3-in. and using a blower giving 28 cu. m. of air at 9-in. of water. The cupola was charged with coke only, and the upper level was maintained at 74-in. above the tuyere level. The conclusions drawn by the author, after completing the Beldon test, are interesting and informative; giving information on what effect the harness and the softness of coke has to do with the inverted cone region of the cupola. These conclusions tend to show it is necessary to determine the zone of complete combustion for each cupola, taking into consideration the quality of the coke and blast pressure. In closing the article the author discusses coke percentage, blast pressure and fluxes. (F.)

Equipment

NEW TRENDS. *"Trends in Foundry Equipment,"* by F. J. Oliver, *The Iron Age,* vol. 146, no. 10. September 5, 1940, pp. 50-54. The major aim of current foundry research is to provide stricter control over the characteristics of castings, without sacrificing quantity output. Changes in the design and operation of foundry equipment over the past few years generally reflected this aim. In this article a summary of recent improvements and changes in equipment and description of new models, from manufacturers' announcements, will be found many suggestions for meeting the qualitative demands for castings users on a production basis. (M.H.)

Fatigue

METALS. *"Fatigue Failure,"* by George Sachs, *The Iron Age,* vol. 146, no. 10,

September 5, 1940, pp. 31-34. It has been found that the fatigue strength is affected in a similar manner by the following three types of "stress risers": machined notches; corrosion, simultaneous with fatigue; and chafing. In any one of these three special types of fatigue, little benefit is derived from alloying and heat treatment. This section deals with notched specimens and corrosion and fatigue strength. The reduction of the fatigue strength by a notch, that is small in relation to the test piece, depends upon two factors, the sharpness of the notch and the nature and strength properties of the metal. Corrision of the metal prior to the fatigue test acts similar as a mechanical notch. (Met.)

Gray Iron

DEFECTS. *"Causes of Gray Iron Casting Defects,"* by W. B. McFerrin, *The Iron Age,* vol. 146, no. 10, September 5, 1940, pp. 44-47. This four page table lists 32 types of defects found in gray iron castings and grades the causes according to degree of probability. Most probable cause indicated (1), second most probable (2), etc. In some instances two causes may be rated with the same degree of probability. (C.)

Magnesium

SURVEY. *"Magnesium and Its Alloys,"* by F. A. Fox, *The Metal Industry* (London), vol. 46, no. 25, June 21, 1940, pp. 537-540. Continuing his series of articles, the author discusses the effect of zinc, manganese, cerium, cadmium and tin as alloying constituents in magnesium. He then continues, in this section of his paper, to deal with sand casting technique. (Al.)

SURVEY. *"Magnesium and Its Alloys,"* by F. A. Fox, *The Metal Industry* (London), vol. 46, no. 26, June 28, 1940, pp. 561-564. In this, the third section of his series of articles, the author concludes his discussion of sand casting technique and goes on to deal with die-casting. The deformation of magnesium alloys and, in particular, the rate of deformation, are considered as well as the processes of annealing and heat-treating. (Al.)

Malleable Iron

PEARLITE. *"Properties of Commercial Pearlitic Malleable Iron,"* by C. H. Lorig, *A.S.T.M. Bulletin,* no. 105, August, 1940, pp. 29-35. The paper attempts to correlate mechanical properties of commercial, pearlitic malleable irons. Various data were secured from producers of pearlitic malleable iron and these along with data available in the literature are summarized in a table and in curves. Close relationships between tensile strength and Brinell hardness appear to exist, as shown herein. In a broad sense these relationships are dependent of the method of preparing the pearlitic malleable irons and are not affected greatly by the character of the combined carbon particles. Evidence indicated that the ductility of pearlitic malleable irons is affected by the microstructure more so than are the tensile strength and yield point. A short review is given of the influence of those individual alloying elments often employed in commercial pearlitic malleable irons. (M.)

Materials Handling

GRINDING WHEELS. *"Fundamentals of Grinding Wheel Selection,"* by B. H. Work, *The Iron Age,* vol. 146, no. 2, July 11, 1940, pp. 42-44. Herein, the second and concluding part, the author discusses the general principles governing the choice of abrasive, grain size, structure, bond and grade of grinding wheels as related to the material being ground and the quality of finish desired. (M.H.)

Molding

STACKING. *"Stack Molding as an Aid to Production,"* by Wm. Y. Buchanan, *Foundry Trade Journal,* vol. 63, no. 1252, August 15, 1940, pp. 107-108. In order to take care of the orders being received by many English foundries they find it necessary to increase production through an increase in the output per unit of floor space. This brings to light the method of building one mold above the other, or stack molding. This is usually carried out in green sand using one drag box, a number of mid parts, and finally, one top part. The number of boxes which can be used in a green-sand stack is limited by the pressure which the lowest box will withstand, and in the case of machine boxes without bars this safe limit is not much over 24-in., even with careful ramming of the drag and hand tucking after setting it down on the floor. Information is given on how to handle oil-sand stacks and how and where to place gates for grouped castings. The assembly of the stack is very important so that the down gates are strictly in line. In conclusion the article contains many of the advantages of this system and gives data on how the oil-sand used in the boxes can be recovered and used over again. (Mo.)

Non-Ferrous

MELTING. *"Hints on Melting Non-Ferrous Metals,"* by N. K. B. Patch, *The Foundry,* vol. 68, no. 9, September, 1940, pp. 37, 105-107. Where no metallurgist is available the foundryman will do well to use the ingot metals produced by the ingot metals manufacturer. The manufacturer has the metallurgical knowledge on hand to insure uniformity of analysis and freedom from the presence of undesirable impurities, and to insure the absence of dissolved gases that may give trouble in the later production of castings. In the production of ingot metals by the foundryman, the question of the type of furnace equipment available, and whether the metals are to be melted in a crucible or an open hearth have a definite bearing on the proper practice. (N.F.)

PATTERN DESIGN. *"Patterns and Pattern Design for Non-Ferrous Foundries," The Foundry,* vol. 68, no. 8, August, 1940, pp. 33, 106-109. Patterns in nonferrous foundries have been given proper study and consideration, largely because of usual conditions that prevail in the production of nonferrous castings. Designers would find that much economy could be secured if the castings to be made in the nonferrous metal were given consideration in ample time to permit the proper study necessary to produce patterns for economical production of best quality castings. The correct pattern will enable foundrymen to make a sounder casting because it has been designed to permit molding in the proper position to insure maximum soundness and complete feeding of all parts during solidification. The proper pattern can be determined best by a conference between the designer or user of the casting and a competent foundryman with the requisite experience in the production of castings in the alloy in question. If the standard color designations are observed carefully by all who make patterns a marked savings in nuisance costs in the foundry will result. Emphasis is placed on the fact that good patterns for the nonferrous foundry must be made so that they can be molded in the proper position to permit attachment of risers at points where they are needed to insure feeding for soundness. (N.F.)

REMEDIES AND DEFECTS. *"Ills and Cures in the Non-Ferrous Foundry,"* by A. Fritschle, *The Foundry,* vol. 68, no. 7, July, 1940, pp. 30-31, 92, 94. This article does not attempt to make a list of the various trouble producing factors in manner of importance. One defect, to the foundryman, is as important as another, though it may be either due to molding or melting. In discussing moisture content the author stresses proper care of sand; if moisture content is neglected it is connected directly with defective castings. He states further that a moisture determining instrument costs very little compared to the dividends it can be made to pay the foundry. Pouring temperature, which is not always properly considered in relation to the square inch area or dimensions of the gates which lead from the runner strip or sprue into the casting proper, is also related. Gates are often pinched together or chocked down to the extent that the metal is sprayed into the mold cavities. Under these conditions the streams of metal become prematurely chilled before they have time to flow around the cores, or to fill the mold properly and, consequently, produce unsound castings. Emphasis is also placed on risers. In discussing the subject of cores and coremaking the importance of the core oven is stressed. The value of having uniform heat distribution is the main factor. Going from cores to pouring metal, the author points out it is quite necessary to see that, so far as possible, no secondary air is drawn into the mold through the sprue when pouring semi-red, yellow brass or manganese bronze mixtures containing a fairly high percentage of zinc. This article was presented before the Regional Conference of the St. Louis District chapter, A.F.A., last October. (N.F.)

SEMI-PERMANENT MOLDS. *"Semi-Permanent Molds for Non-Ferrous Casting Production,"* by Frank Hudson, *Foundry Trade Journal,* vol. 63, no. 1248, July 18, 1940, p. 39. Small and isolated foundries can materially increase production of suitably designed castings such as bushes, large washers, small propellers, etc., by the use of semi-permanent molds. Best results are obtained on the more simple bronze, gunmetal and brass castings, free from intricate cores, normally made in two-part boxes. In order to obtain maximum casting solidity and to reduce the need of feeding risers as much as possible, the mold should have a high thermal conductivity, and this can be received by the use of a silicon-carbide or graphite base material. A suggested sand mixture for semi-permanent molds is 97 per cent dry silicon-carbide sand and 3 per cent concentrated sodium silicate. Molds are rammed up in the normal manner. The surface of semi-permanent molds made from silicon-carbide mixture is inclined to be rough, and the required degree of casting finish is obtained by treating the mold with a suitable surface dressing. (N.F.)

Non-Ferrous Alloys

TINNING. *"Tinning Copper and Brass by Immersion,"* by John D. Sullivan and A. E. Pavlish, *Foundry Trade Journal,* vol. 63, no. 1251, August 8, 1940, p. 90. This paper deals with an immersion process and a new tin bath that can be used to apply

coatings to copper and brass, including intricate shapes, at ordinary room temperature. The coating gives protection to tubing against "green water" and has many other applications, some of which are mentioned in this article. (N.F.)

Safety

CLEANING DEPARTMENT. *"Cleaning Dangers in Tumbling Parts," "Daily Metal Reporter, Brass and Aluminum Foundry Section,"* vol. 140, no. 134, part 2, July 13, 1940, pp. 1, 4. Tumbling may be used for removal of scale, sand and rust, as well as for smoothing up, breaking off fins and projections, reducing internal strains and for polishing and burnishing effect. Wet tumbling mills are adapted to cleaning non-ferrous materials or products to be dried subsequently so as to prevent oxidation, or for parts not affected by oxidation. The details for the removal of dust and dirt by the use of some exhaust system are given along with air velocities and water pressures. All exhausting mills shall have the exhaust system designed in accordance with the rules and regulations prescribed in A.F.A's. Recommended Practice Code and Handbook on Fundamentals. (Se.)

FOUNDRY PROGRAM. *"Welfare—Safety Program Pays," Steel,* vol. 107, no. 10, September 2, 1940, pp. 38-39. The elaborate worker welfare and safety program carried out by American Manganese Steel division of American Brake Shoe & Foundry Co. is based on cleanliness, good housekeeping and interest in the individual worker. The effects of such a program is shown by the way accidents have been reduced in the plants of this company. (Se.)

HEALTH. *"It Takes Health Plus Safety to Do the Job,"* by M. L. Robb, *Steel,* vol. 107, no. 3, July 15, 1940, pp. 44-45, 62. It is pointed out that a real health program in any plant pays well. A healthy employe on the job is more efficient and safer than a new man. The idea of such a campaign is not to just rid the plant of accidents, because the real profit comes in keeping workers healthy. The plan of this company is aimed at eliminating accidents and occupational diseases through the health and safety program. If effective, such a program is more far-reaching than merely prevention of accidents. Good working conditions increase efficiency, which results, in most cases, in higher wages and a better return on the company's investment, hence everyone benefits by this plan. (Se.)

Sand

COAL FACINGS. *"A Comparative Study of Some British Coal Dusts in Green-Sand Mixtures,"* by A. N. Sumner, *Foundry Trade Journal,* vol. 63, no. 1248, July 18, 1940, pp. 41-42. This is a study undertaken to improve the skin finish of green-sand castings and it became necessary to ascertain the effect of various coal-dust additions made from British coals. The series of tests described in this article represents comparison tests only, as it was fully realized that the effect of milling under practical foundry operating additions may affect the results, but as every care was taken to maintain uniformity it is felt that the results are of general interest. Coal dusts were used in eleven different batches and were discussed in relation to their effect on casting finish. The summary of the tests show that out of the 27 coal-dust and three blacking samples used, the Staffordshire fine-grade coal dust gave the best casting finish. The author conducts two further tests to substantiate his claim. (Sa.)

COOLING. *"Cooling Sand,"* by F. H. Amos, *The Foundry,* vol. 68, no. 8, August, 1940, pp. 34-35, 92. It seems, to the author by means of experimentation and research, that the only way to cool molding sand for continuous high production units is by evaporation of moisture in the sand after shakeout. When the moisture drops below a certain point, the sand in the conditioning unit gradually increases in temperature and this rate of increase is directly proportional to the moisture deficiency after shakeout. The only remedy, when a sand system acts this way, is add more moisture to the hot returning sand. To take full advantage of evaporation, or cool the sand down to a good working temperature, some means must be provided for opening the sand so that the vapor may escape. (Sa.)

Spectrography

NON-FERROUS. *"Spectrography in Non-Ferrous Metallurgy,"* by F. Twyman, *"Daily Metal Reporter, Brass and Aluminum Foundry Section,"* vol. 140, no. 134, part 2, July 13, 1940, pp. 1-2, 12. In the past five years over a hundred investigators have published papers on spectrochemical analysis, most of which have contributed something to the subject, and the metallurgist, whether he is interested in high-purity or commercial copper or various other alloys, can readily find well-tried data for spectrochemical analysis. The results of many investigations have established that, with certain important qualifications and within certain limits: (1) any mixture or combination of elements can be made to emit a line spectrum characteristic of those elements; (2) in such spectra the intensities of the lines of the various elements have a relation to each other which depends only on the percentages present; and (3) small variations in the percentages of any particular element present cause no variation in the intensities of the lines of the other elements. Qualitative spectrum analysis resolves itself, therefore, into a measurement of the intensities of spectral lines. The theories and observations advanced by many observers today help to substantuate the recommendation of Gerlach and Schweitzer to use for the measurements, wherever possible, only lines whose intensities relative to each other do not vary with even widely varying conditions of the arc or spark. It is in using the spark that most progress has been made in qualitative analysis in the past five years. Discoveries of numerous other investigators are also discussed in this paper. (N.F. and Ml.)

Steel

HEAT AND CORROSION RESISTANT. *"Heat and Corrosion Resistant Castings,"* by D. W. Talbott, *Steel,* vol. 107, no. 5, July 29, 1940, pp. 38-40. The second section of this paper deals with corrosion-resistant alloys, popularly referred to as stainless steels. These alloys, when properly selected, do not stain or corrode in many solutions or atmospheres destructive to ordinary steel. The 18-8 alloys have by far the widest field of application. These alloys, although austenitic, are not stable since a partial change in the austenite takes place when heated near 1200° F. There is a loss in the corrosion resistance of the alloy due to the precipitation of carbide at the grain boundaries. Research has been started to see if this defect cannot be overcome. Proper balances of chromium, nickel and carbon or by the addition of some element that holds the carbon in solution have been found to work out correctly. Other elements such as columbium, titanium and tantalum have been received favorably. Service conditions have been modified by addition of other elements such as molybdenum in amounts of 2 to 4 per cent to prevent "pinholes" or "pit corrosion." Comments are made on chromium and chromium and nickel alloys and their uses in various industries. (C.)

HOT TEARS. *"Prevent Hot Tears in Steel Castings,"* by W. J. Phillips, *The Foundry,* vol. 68, no. 7, July, 1940, pp. 27-28, 87-89. Research has established the fact that there is a decided difference in the contractional properties of steels of varying carbon and alloy content. This research has gone far toward explaining some of the apparent anomalies encountered in the production of steel castings and has indicated the necessity of maintaining chemical composition within well controlled limits. Steel used in this investigation was made in an acid lined 1½-ton electric furnace. The charge was melted down under a black slag, boiled down to 0.06 to 0.08 per cent carbon, recarburized with low silicon pig iron and the boil continued until the desired temperature was reached, at which time additions of ferromanganese and ferrosilicon were made to the furnace and stirred. Final addition of aluminum, in the proportion of 0.10 per cent, was made to the furnace by ingot aluminum wired to a rod and plunged beneath the slag. The first investigation studied the effect of varying core hardness upon the formation of hot tears. Data gathered from this series of tests did not offer a solution to the problem of variation in cracking intensity sometimes encountered in the bull ladle on excessively hot heats. It was found that those castings which showed cracks on any heat were those which had been poured from the last metal in the ladle; consequently an investigation was started to study this metal that was exposed to the action of the slag and atmosphere. The results showed that a definite relationship was established between the presence of hot tears in the test castings and the inclusion types. The types of inclusions discussed and the conclusions adopted by the author make interesting and informative reading. (S.)

VALVE PRODUCTION. *"Steel Valve Castings,"* by J. J. Kanter, *The Iron Age,* vol. 146, no. 2, July 11, 1940, pp. 29-33. Modernization in the production methods of making steel castings makes possible highly dependable pressure tight castings for valves and fittings in small sizes which, by former production methods, was considered not practical. Through the application of scientific design, molding, composition, melting, pouring, heat treatment and inspection, the supposedly limitations for steel castings conceived by engineers has been overcome. The intensive study upon, not any single one, but all of these factors, has contributed to the successful production of these difficult pressure castings which are dependable in every regard for severe conditions of high temperature and high pressure service. This article describes the production of such castings, and their metallurgy, testing and performance. This article also appeared in the *Valve World,* vol. 37, no. 4, July-August, 1940. (S.)

YIELD. *"Foundry Practice Affects Yield,"* by J. B. Atkinson, *The Foundry,* vol. 68,

no. 8, August, 1940, pp. 28-29, 94, 96. Yield in a steel foundry means the difference between the metal charged into the furnace and the metal shipped as castings to the customers. This one word has more bearing on operating costs, sales prices to customers and profits and losses to a company than any other word in the foundrymen's vocabulary. Because the foundry department controls most of the influences that govern the yield, it may be well to refer to some of the contributing factors that they may be studied and used to the greatest advantage. The factors include molding, heading and gating, use and design or shape of the chills, venting necessary to produce solid castings. Each one of these factors is studied and discussed in detail by the author and brings to light many new ideas on yield that make interesting reading for all foundrymen. (S.)

Steel Melting

ACID AND BASIC. *"Acid and Basic Steel Melting Practice," Industrial Heating,* vol. 7. no. 7, July, 1940, pp. 598, 600, 602. C. E. Sims, research metallurgist, Battelle Memorial Institute, gave a lecture on the application of chemistry to acid and basic practice before the Steel Founders' Society of America and the Electric Metal Makers' Guild. The reviewing of acid and basic practice in regard to electric steel making practice, in this article, begins with a definition of terms, such as oxides, basic oxides, flux, oxidizing slag, etc. An outline of the reactions that occur in the acid process and the basic practice are given. The ways and means of desulphurization and deoxidation are also contained. In closing his article the author deals with hydrogen in steel and finishing methods. (S.)

Stress Raisers

MECHANICAL EFFECTS. *"Stress Raisers,"* by G. Sachs, *The Iron Age,* vol. 146, no. 5, August 1, 1940, pp. 31-34. Frequently parts yield or break under a strain which does not surpass a fraction of the typical value, while occasionally the strength of the structure is found to be considerably higher than calculated. Stress raiser, as a general term, is used to characterize any condition which causes considerable local increases of the magnitude of the stress. The most common stress raiser is an irregularity in the section, or "notch," such as a surface dent, a groove, a thread, a keyway and a section change. Stress raisers, and particularly mechanicl notches, have been investigated extensively for the following types of mechanical tests: static tension, notched bar impact bending and fatigue, mainly of the reversed bending type. Attempts, supported by extensive experimental investigations, have been made to correlate the results obtained on notched bar tensile tests with the conception that a brittle break should occur with any metal if subjected to a three-axial tension. A method for determining the approximate magnitude of the lateral (elastic) stress in the notched section of a bar is also advanced. Notched bar tension tests are commented on at the end of the article. (T.)

October Chapter Meeting Schedule

October 1

Michiana
La Salle Hotel, South Bend
G. W. CANNON AND DR. C. M. COLIGON
Campbell, Wyant and Cannon Foundry Co., Muskegon, Mich.
"Safety, Hygiene, Good Housekeeping and Occupational Diseases"

✦ ✦

October 4

Western New York
Hotel Touraine, Buffalo
A. W. GREGG, Whiting Corp., Harvey, Ill.
"Cupola Practice and Mechanical Charging"

✦ ✦

October 7

Central Indiana
Hotel Washington
JAMES R. ALLAN, International Harvester Co., Chicago, Ill.
"Trends in State Regulatory Codes Affecting Safety in the Foundry Industry"

✦ ✦

October 8

Cincinnati
Hotel Alms
C. A. BARNETT, Foundry Equipment Co., Cleveland, Ohio
"Recent Developments in Core Baking and Core Drying Practices"

✦ ✦

October 9

Metropolitan New York-New Jersey
Essex House, Newark, N. J.
W. G. REICHERT, American Brake Shoe and Foundry Co., Mahwah, N. J.
"Castings Finish"

✦ ✦

October 10

St. Louis District
Hotel De Soto
Round Table Discussion
D. J. REESE, International Nickel Co., *"Gray Iron"*
CLYDE WYMAN, *"Steel"*
J. W. KELIN, Federated Metals Div., A. S. and R. Co., *"Non-Ferrous"*

Northeastern Ohio
Cleveland Club
Equipment Night

✦

Northern Illinois-Southern Wisconsin
Beloit, Wisconsin
EARL E. WOODLIFF, Engineer, H. W. Dietert Co.
"Relation of Sand Control to Sand Conditioning"

✦ ✦

October 11

Central New York
Hotel Onondaga, Syracuse
HARRY W. DIETERT, H. W. Dietert Co., Detroit, Mich.
"Sand"

✦

Philadelphia Chapter
Engineers Club
L. P. ROBINSON, Sales Director, Werner G. Smith Co., Cleveland, Ohio
"Coreroom Problems"

✦

Northern California
Sequoyah Country Club, Oakland
Outing

✦ ✦

October 14

Chicago
Chicago Towers Club
COL. DONALD ARMSTRONG, Chicago Dist. Ordnance Office, Chicago, Ill.
"Industrial Mobilization"

✦ ✦

October 17

Detroit
Detroit Leland Hotel
A. W. GREGG, Whiting Corp., Harvey, Ill.
"Cupola Operation"

✦ ✦

October 18

Wisconsin
Schroeder Hotel, Milwaukee
Sectional Meeting
ED. ROTH, Gen. Mgr., Motor Castings Co., Milwaukee, Wis. (Gray Iron)
"Use of Alloys in Castings"
MARTIN HARDER, Supt., Lakeside Malleable Castings Co., Racine, Wis. (Malleable) *"Gating, Feeding and Scrap Clinic"*
WILLIAM GEORGE, Fdry. Eng., R. Lavin and Sons, Inc., Chicago, Ill. (Non-Ferrous) *"Production of Pressure Castings"*
L. H. HAHN, Met., Sivyer Steel Castings Co., Milwaukee, Wis. (Steel)
"Metallurgy for the Foundryman"

✦

Birmingham District
Tutwiler Hotel
LIEUT. COL. L. H. CAMPBELL, Ordnance Department, Washington, D. C.
Movie: *"The Manufacture of Shells"*

✦ ✦

October 21

Quad City
Fort Armstrong Hotel, Rock Island, Ill.
C. M. DALE, Mgr. Liberty Foundries Co., Rockford, Ill.
"Founding of Piston Rings"

✦ ✦

October 24

Southern California
Clark Hotel, Los Angeles

✦ ✦

October 25

Ontario
Royal York Hotel, Toronto
HERBERT H. FAIRFIELD
"Laboratory Controlled Castings"

✦ ✦

Chapter Organization

October 14

Baltimore-Washington District
Lord Baltimore Hotel, Baltimore, Md.
L. P. ROBINSON, Werner G. Smith Co., Cleveland
"Practical Core Problems"

✦ ✦

Regional Meeting

Februray 20 and 21
Wisconsin Chapter
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Hotel Schroeder, Milwaukee

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